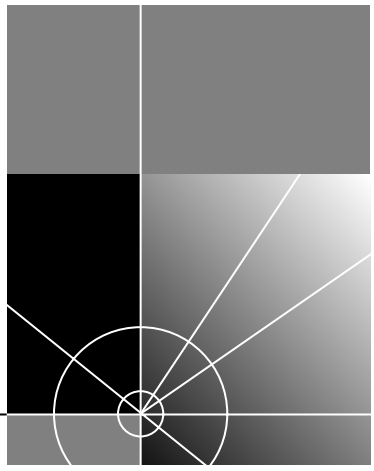
# 3Com OfficeConnect 56K Business Modem Command Reference



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**GLOSSARY**

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# ABOUT THIS GUIDE

## Introduction

This guide is a command reference for the 3Com OfficeConnect 56K Business Modem. It includes information about AT commands, S-Registers and troubleshooting.

*If the information in the release notes shipped with your product differs from the information in this guide, follow the instructions in the release notes.*

## Finding Specific Information in This Guide

This table shows the location of specific information in this guide.

| If you are looking for information about | Turn to |
|---|---|
| Connecting to your ISP | Chapter 1 |
| Upgrading Your Busniess Modem | Chapter 3 |
| Basic AT Commands | Chapter 2 |
| Display Querying and Help Screens | Chapter 14 |
| Testing a Connection | Chapter 15 |
| Troubleshooting | Chapter 17 |
| S-Registers | Appendix A |
| Alphabetic Command Summary | Appendix B |

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## Conventions

Table 1 and Table 2 list conventions that are used throughout this guide.

**Table 1** Notice Icons

| Icon | Notice Type | Description |
|---|---|---|
| | Information note | Important features or instructions |
| | Caution | Information to alert you to potential damage to a program, system, or device |
| | Warning | Information to alert you to potential personal injury |

**Table 2** Text Conventions

| Convention | Description |
|---|---|
| **Commands** | The word "command" means you must enter the command exactly as shown in text and press the Return or Enter key. You may also be asked to fill in values for variables. Example:<br>wait *n* seconds between losing the connection and redialing:<br>**ATS44=*n***<br>*This guide always gives the full form of a command in uppercase and lowercase letters. However, you can abbreviate commands by entering only the uppercase letters and the appropriate value. Commands are not case-sensitive.* |
| `Screen displays` | This typeface represents information as it appears on the screen. |
| The words "enter" and "type" | When you see the word "enter" in this guide, you must type something, and then press the Return or Enter key. Do not press the Return or Enter key when an instruction simply says "type." |
| (continued) | |
| [Key] names | Key names appear in text in one of two ways:<br>■ Referred to by their labels, such as "the Return key" or "the Escape key"<br>■ Written with brackets, such as [Return] or [Esc].<br>If you must press two or more keys simultaneously, the key names are linked with a plus sign (+). Example:<br>Press [Ctrl]+[Alt]+[Del]. |
| *Menu commands* and *buttons* | Menu commands or button names appear in italics. Example:<br>From the *Help* menu, select *Contents*. |

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**Table 2** Text Conventions (continued)

| Convention | Description |
|---|---|
| Words in *italicized* type | Italics emphasize a point or denote new terms at the place where they are defined in the text. |
| Words in **bold-face** type | Bold text denotes key features. |

## Related Documentation

The *3Com OfficeConnect 56K Business Modem Installation Guide* should be used for the installation of the Business Modem.

## Year 2000 Compliance

For information on Year 2000 compliance and 3Com products, visit the 3Com Year 2000 web page:

http://www.3com.com/products/yr2000.html

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# 1 CONNECTING TO YOUR ISP

This chapter contains information about configuring your modem for various operating systems.

- Windows 95/98
- Windows NT 4.0 and Later
- Macintosh
- Other Operating Systems

## Windows 95/98

The first time you start Windows 95/98 after you've installed the modem, Windows 95/98 will auto-detect your modem. Since Windows 95/98 supports Plug and Play, most installations are trouble-free.

You must power on your modem before you start Windows 95/98, or Windows 95/98 will not recognize your modem.

### What You Need

You need Windows 95/98 with Dial-Up Networking installed to configure your modem for Windows 95/98.

### Configuring Your modem with Plug and Play

Plug and Play mode allows Windows 95/98 to automatically detect your modem and determine which modem configuration file (called an INF file) to use.

**Follow the steps below to install the INF file for Windows 95/98:**

1. Power on your computer and start Windows 95/98. Your computer will detect new hardware.
2. When the ***New Hardware Found*** window appears, select *Driver from disk provided by hardware manufacturer* and click OK.

   This step will install the INF file that is provided on the *Connections* CD-ROM.

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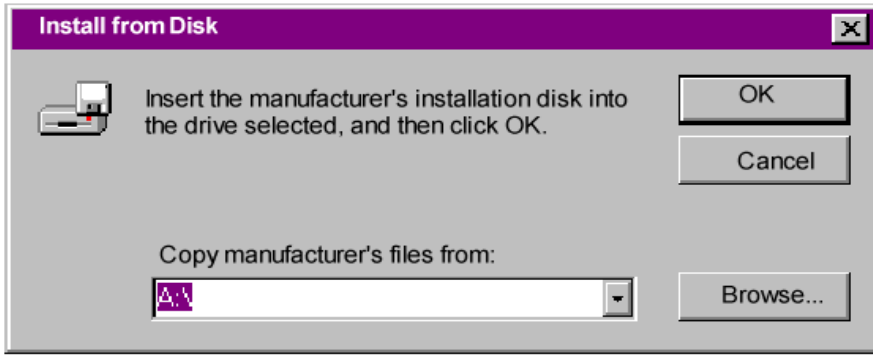
3 When the following window appears, insert your Connections CD-ROM, change the default drive in *Copy Manufacturer's files from:* to **D:** (or the correct path of your CD-ROM) and click OK to install the INF file.




4 Windows 95/98 displays a window asking you to choose your modem type from the list. Select the your modem from the list and click OK.

Your modem is now ready to use!

**Files Needed By Your modem**

For your modem to work most efficiently, 3Com recommends that you use the latest version of the modem software and information (INF) file from the 3Com U.S. Robotics Web site (http://www.usr.com/home/online/).

| This file | Does this |
|---|---|
| The modem software | Contains software that contains new feature updates |
| The INF file | Helps your computer work more effectively with your modem |

**Installing the Latest Software**

See Chapter 3, *Upgrading your Modem* for information about upgrading your Business Modem's software.

**Accessing Your Internet Service Provider**

This section explains how to set up your modem to access the Internet or remote Local Area Networks (LANs) using Windows 95/98 Dial-Up Networking. To Access Internet Service Providers (ISPs) or remote LANs you must do the following:

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### Step One: Determine if Dial-Up Networking is Installed

1 Click **Start** | **Settings** | **Control Panel**.

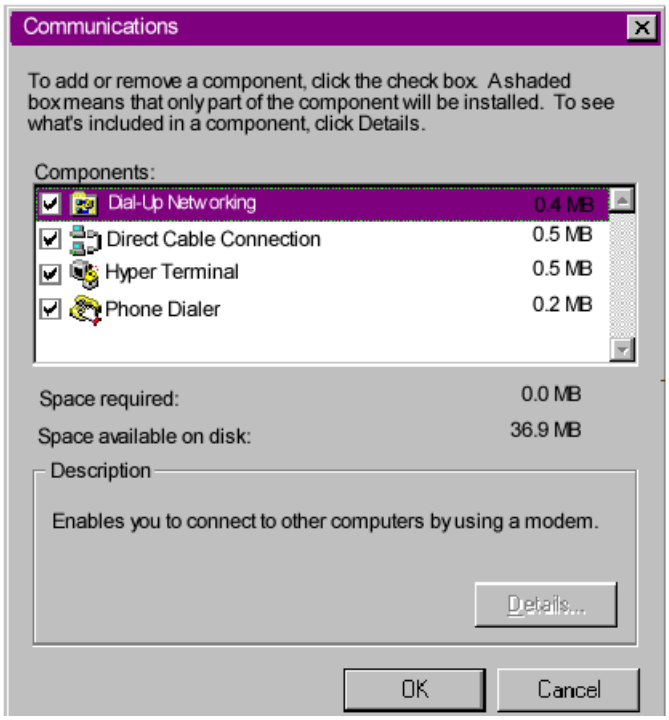
2 On the Control Panel, double-click on **Network**. The *Network* widow will appear.

| If Dial-Up Adapter | Do this |
|---|---|
| Is listed | Go to the section "Installing TCP/IP Support" to install Dial-Up Networking. |
| Is not listed | Go to Step 3. |

3 Return to the Control Panel and double-click on **Add/Remove Programs** to open the *Add/Remove Programs Properties* window.

4 Click Windows Setup tab.

5 Double-click on **Communications.** The following window appears:


Communications
To add or remove a component, click the check box. A shaded box means that only part of the component will be installed. To see what's included in a component, click Details.
Components:
Dial-Up Networking 0.4 MB
Direct Cable Connection 0.5 MB
Hyper Terminal 0.5 MB
Phone Dialer 0.2 MB
Space required: 0.0 MB
Space available on disk: 36.9 MB
Description
Enables you to connect to other computers by using a modem.
Details...
OK
Cancel

6 Click on Dial-Up Networking to check the box.

7 Click OK | OK.

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8 Insert your Windows 95/98 Setup diskette or CD-ROM when you are prompted, and Windows 95/98 installs Dial-Up Networking.

### Step Two: Installing Dial-Up TCP/IP Support

1 Click **Start** | **Settings** | **Control Panel**.

2 On the Control Panel, double-click on the **Network** to display the *Network* window:

3 Determine if the TCP/IP Dial-Up Adapter is installed:

| IF TCP/IP -> Dial-Up Adapter | Do this |
|---|---|
| Is not listed | Click **Add** \| **Protocol** \| **Microsoft** \| **TCP/IP** \| **OK**. Insert your *Windows 95/98 Setup* diskette or CD-ROM when you are prompted, and Windows 95/98 installs TCP/IP protocol support. |
| Is listed | Go to Step 3. |

### Step Three: Setting Up a Connection to Your ISP

1 Click **Start** | **Programs** | **Accessories** | **Dial-Up Networking**.

2 Double-click **Make New Connection**.

3 Select the correct modem, if not already selected.

4 Type a name for the connection and click **Next**.

5 Type a phone number for the connection and click **Next**.

6 You should see a message indicating that a new connection was created successfully.

7 Click **Finish.**

8 A **New Connection** icon will be created in the *Dial-Up Networking* Window. Move your cursor to the new icon you have just created and click the right mouse button. Select Properties on the menu to display the following window:

*The following screen may vary slightly depending on the version of Windows 95/98 you are using.*

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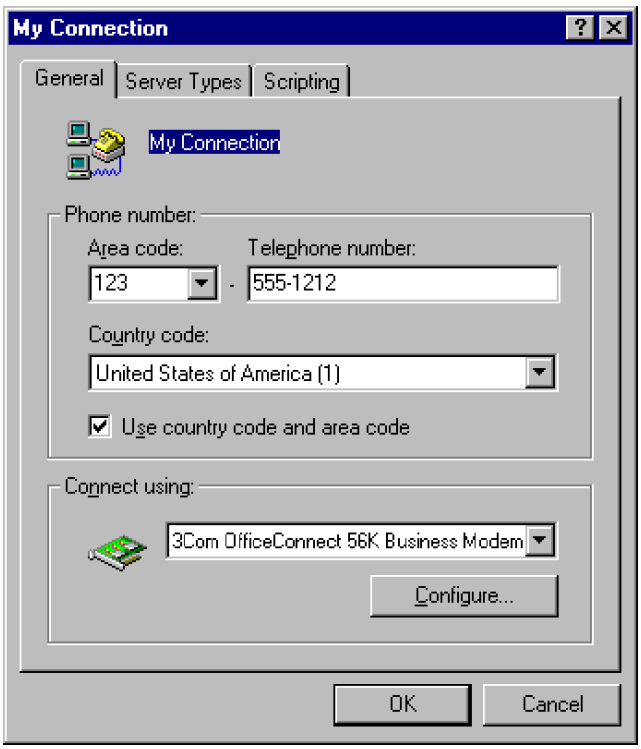


**9** On the *My Connection* window, click **Server Type**, and deselect the following:

- Log on to Network
- NetBEUI
- IPX/SPX Compatible

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10 Click **OK**, and **OK**.

| If your ISP | Do this |
|---|---|
| Gives you a specific IP or Domain Name server addresses | Go to *Step Four: Customizing TCP/IP Settings* |
| Does not give you a specific IP or Domain Name server addresses | Double-click on the icon you just created to dial your ISP. |

### Step Four: Customizing the TCP/IP Settings

Depending on the ISP you use, you may need to customize the TCP/IP settings. Follow steps 1-6 and if you still cannot connect to your ISP contact you can contact your ISP for specific information such as an IP address or Domain Name Servers (DNS).

1 Double-click **My Computer** and double-click **Dial-Up Networking** to display all the connections you can customize.

2 Right-click the icon you created and select **Properties** to display the *My Connection* properties window.

3 On the My Connection properties window, click the **Server Type** tab.

4 Click **TCP/IP Settings**

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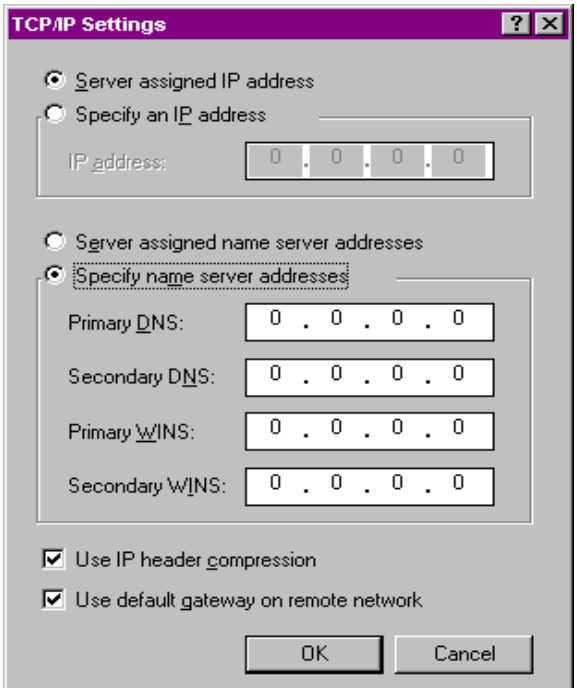


**5** Specify an IP address, if needed:

| If your ISP | Do this |
|---|---|
| Gives you a specific IP address | Click **Specify an IP address** and enter the IP address provided by your ISP |
| Does not give you a specific IP address | Click S**erver assigned IP address** |

**6** After you specify an IP Address, specify server assigned name server addresses, if needed:

| If your ISP | Do this |
|---|---|
| Gives you specific name server addresses | Click **Specify name server addresses** and enter the server address(es) provided by your ISP |
| Does not give you specific name server addresses | Click **Server assigned server address** |

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7 Double-click your **New Connection** icon to connect!

## Windows NT 4.0 and Later

TCP/IP is the main protocol used to transfer data via the Internet. To use TCP/IP with Windows NT, you must connect to your ISP using a PPP or SLIP connection.

*Each ISP has different requirements. Before using this chapter to configure Windows NT to access your ISP, contact your ISP to determine if they have special instructions for Windows NT users.*

| For you to | Use this connection |
|---|---|
| Use a dial-up connection to connect over the Internet.<br>SLIP only allows you to connect using IP and does not allow for server assigned IP addresses or server assign name server addresses. | Serial Line Internet Protocol (SLIP) |
| Use a dial-up connection to connect over the Internet.<br>PPP allows you to connect using IPX, TCP/IP, Netbeui, and other protocols. PPP is a more recent development than SLIP and has become the standard way of connecting to the Internet. | Point-to-Point Protocol (PPP) |

***CAUTION:*** *Before you use these procedures, contact your ISP to determine if they have any special requirements.*

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**What you need**

Before you begin, obtain the following information:

- Does your ISP have a SLIP or PPP account?
- Your ISP's telephone number
- Does your ISP supply a static or dynamic IP address?
- Your ISP's primary and secondary DNS servers
- INF file for Windows NT

**Configuring Your modem**

Since Windows NT is not Plug and Play compliant, it is necessary to install the modem in Modem Properties.

*Your modem should already be installed. If you have not connected your Business Modem to your computer, please refer to the Getting Started Manual for installation instructions.*

1. Go to **Start** | **Settings** | **Control Panel** | **Modems**
2. Click **Add**
3. Check **Don't detect my modem; I will select it from a list**
4. Click **Next**
5. Click **Have Disk**.
6. Place the diskette or CD-ROM that was packaged with your Business Modem into your floppy disk or CD-ROM drive. Select the INF file found on the disk.
7. Select the COM port for your Business Modem.
8. When the installation is complete, Windows NT will request that you restart your computer. Select **yes**.

**Setting up RAS**

1. Right click on the **Network Neighborhood** icon on your desktop and select **Properties**.
2. Click the **Services** tab.
3. Select **Remote Access Service** and click **Properties**.
4. Click **Add**.
5. Select your Business Modem's COM port and click **O**K.
6. Highlight your Business Modem and click **Configure**.
7. Select the function of your modem and click **OK**.

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8 Click **Network.**

9 Select the protocols required to dial in and out with your Business Modem.

10 Set **Encryption Settings** to **Allow any authentication including clear text**.

11 Click **Continue** to complete RAS setup.

**Determining if TCP/IP is installed**

TCP/IP must be installed before you can access the Internet. Although this is a standard configuration, double-check to make sure TCP/IP is installed.

To determine if TCP/IP is installed, perform the following actions:

1 Select **Start** | **Settings** | **Control Panel**

2 Double-click **Network**

3 On the **Protocol** tab, scan down the list of installed protocols to find **TCP/IP Protocol Adapter**.

4 If TCP/IP Protocol is listed, skip to section *Configuring a PPP Connection*.

If TCP/IP Protocol is NOT listed move to the next section.

**Installing TCP/IP**

To install TCP/IP, perform the following actions:

1 Select **Start** | **Settings** | **Control Panel**

2 Double-click **Network**

3 On the **Protocol** tab, click **Add**, and select the **TCP/IP protocol** from the list.

**Configuring a PPP connection**

To configure the Business Modem for a PPP connection, perform the following actions:

1 Go to **Start** | **Programs** | **Accessories** | **Dial Up Networking**

2 Click **New**.

3 Select the **Server tab** and select **PPP** in the Dial-up server type box.

4 Select **TCP/IP**

5 Deselect **NetBEUI** and **IPX**.

6 If you are connecting to an ISP, uncheck **Enable PPP LCP Extensions**

If you are connecting to another Windows NT system, Check **Enable PPP LCP Extensions**

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7 Select **Enable software compression**.

8 Specify an IP address by clicking **TCP/IP settings**.

| If your ISP | Do this |
|---|---|
| Gives you a specific IP address | Click **Specify an IP address** and enter the IP address provided by your ISP |
| Does not give you a specific IP address | Click **Server assigned IP address** |

9 After you specify an IP Address, specify server assigned name server addresses, if needed

| If your ISP | Do this |
|---|---|
| Gives you specific name server addresses | Click **Specify name server addresses** and enter the server address(es) provided by your ISP |
| Does not give you specific name server addresses | Click **Server assigned server addresses** |

**Configuring a SLIP connection**

The following steps explain how to configure Windows NT for use with a SLIP connection.

1 Double-click **Dial-Up Networking**.

2 Click **New**

3 Select the **Server tab** and select **SLIP** in the Dial-up server type box.

4 Click **TCP/IP settings**.

5 Enter the IP address provided by your ISP.

6 Enter the primary DNS and secondary DNS server IP addresses in the appropriate name server address boxes.

7 If your ISP requests that you use a specific frame size, select the desired frame size in the Frame Size box.

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### Troubleshooting RAS

RAS is significantly easier to troubleshoot then Win95 Dial-Up Networking, there are a finite number of problems that one runs into on a daily basis, and the majority of these are caused by misconfiguration. Most connection problems can be solved by following these steps:

- In the **Basic** tab, Make sure that the phone book entry settings are correct.
- Make sure **Use Telephony Dialing Properties** is unchecked
- Make sure to that **Use another port if busy** is not checked.
- In the phone book settings, under security, it should be set to: **Accept any authentication including clear text**.
- Make sure only the necessary network protocols are selected.
- In the *Connect to* window, after you click **Dial**, there should be no domain set. This is only for logging into NT domains.
- Make sure that the TCP/IP settings are correct.

*This is a general setup for your Business Modem using Windows NT. If you are having problems connecting to you ISP, configuring Dial-Up Networking, or receiving RAS errors, please contact Microsoft Technical support.*

## Macintosh

This section explains how to configure your modem for use with Macintosh computers.

*There are many ways to configure your Macintosh to use the Internet. Consult your Macintosh documentation for more information.*

### Handshaking Cable

Use a hardware handshaking cable to connect your modem to the Macintosh.

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**System Configuration**

Also, if you aren't using AppleTalk® Remote Access (ARA), set AppleTalk to Inactive (in Chooser).

The modem initialization string should be **AT&F1&D0**.

For instructions about how to set up your Macintosh communications software package, see the software installation instructions that came with the software.

**Accessing the Internet**

Accessing the Internet through an ISP requires the following software:

- MacTCP or Open Transport (TCP/IP from the Control Panels menu), which has probably already been installed on your Macintosh
- SLIP or PPP dialing software

*You can find public domain PPP dialers (such as MacPPP, FreePPP) on the Internet.*

**Macintosh (230K) High Speed script installation**

To enable the 230K DTE support for the Business Modem and 25 mhz Business Modem you first must install the Macintosh (230K) High Speed Script and then configure Open Transport PPP.

**Installing the script**

1. Download the **USRARA.HQX** file.

   This file can be found on the internet at http://www.usr.com/home/online/ in the software library area. It can also be downloaded from the BBS at 847-262-6000.

2. After the file is downloaded, it needs to uncompressed. When the file is uncompressed the **USRARA.SEA** Folder appears.
3. Inside the USRARA.SEA folder is a readmefirst.txt file and the 3Com High Speed script.
4. Move the script file to the following path **C:\System\Extensions** and create a folder named **Modem Scripts**.

   Once you place the script in the Modem Scripts folder you will have the option to choose the 3Com High Speed in Open Transport PPP or ARA.

   The script will attempt to talk to the modem at 230.4 port speed and if this fails, it will attempt at the next lowest speed. This will continue until

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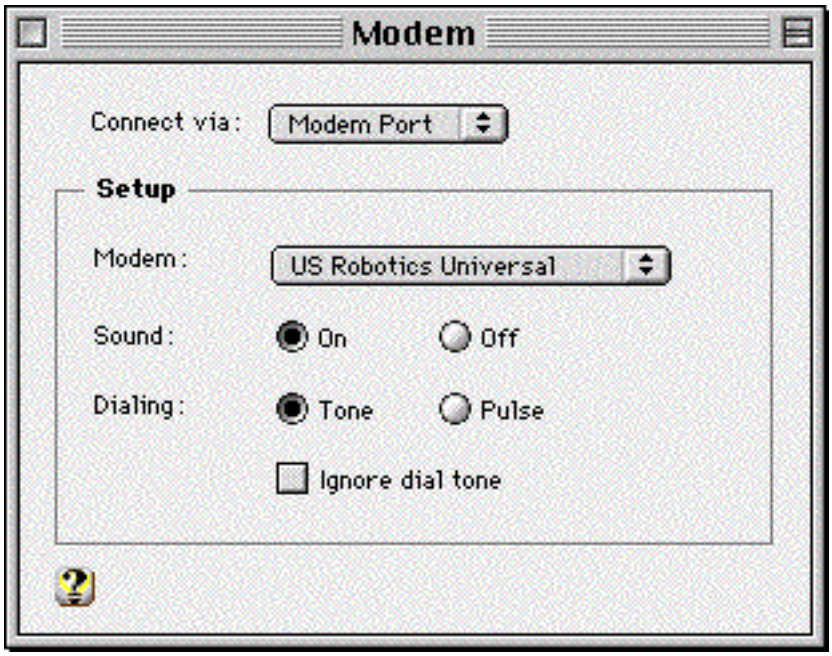
the script receives an OK back from the modem and/or the system responds with a proper speed.

### Configuring Open Transport PPP

Selecting the correct modem

1. Go to **Apple Menu | Control Panels | Modem**.
2. In the *Modems* Window, choose the **port** that your modem is connected to in the **Connect via** drop down box.
3. Select the correct modem, in the **Modem** drop down box.

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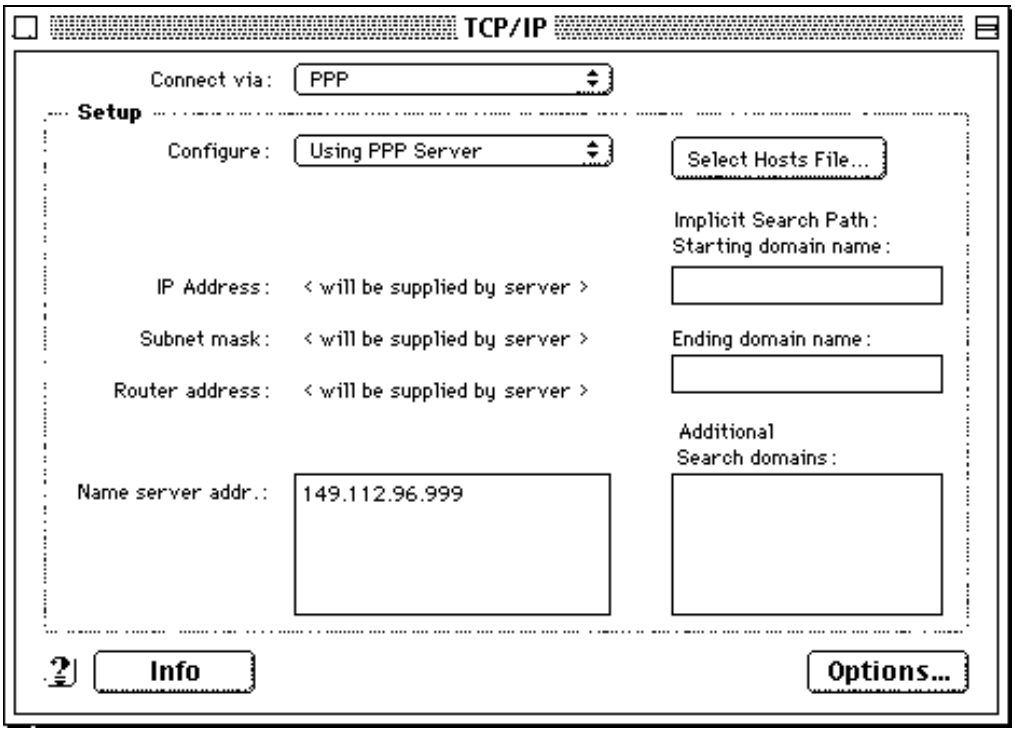
## Selecting the correct TCP/IP settings

1. Go to **Apple Menu | Control Panel | TCP/IP**.
2. In the *TCP/IP* window, select **PPP** in the **Connect via** drop down box.
3. Set the **Configure** drop down box to **Using PPP Server**.
4. Type in your internet service providers Domain Name Server Address(DNS) numbers in the **Name server addr** box.
5. Leave the other fields empty.

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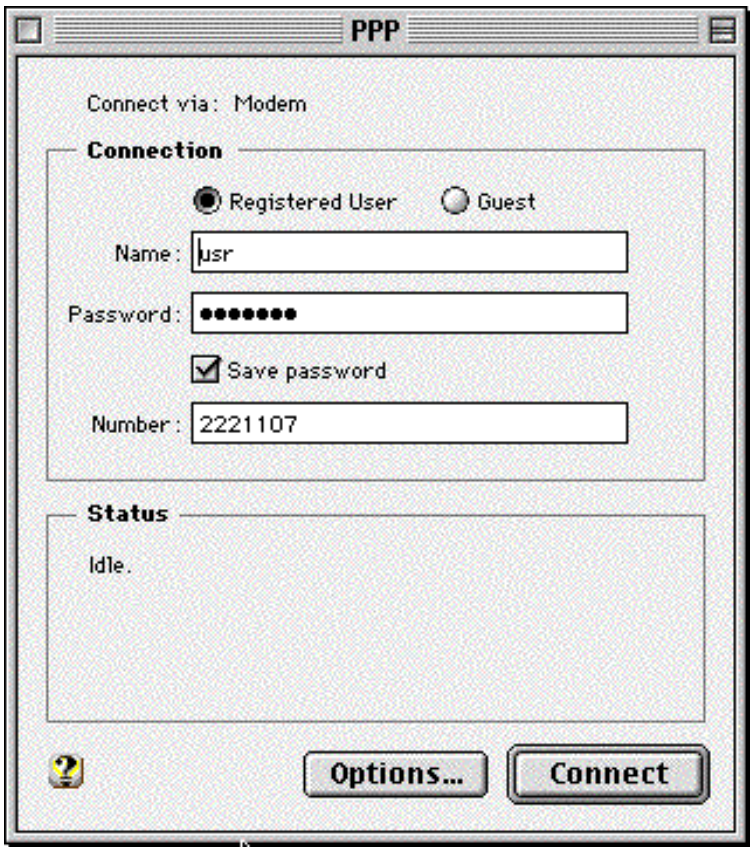
### Setting up your ISP information

1. Go to **Apple Menu | Control Panels | PPP**.
2. In the *PPP* window, select **Registered User**.
3. Type in your Internet Service providers login name and your password in the name and password boxes.
4. Put the phone number that you dial to connect to your internet provider in the number box.




You've successfully configured Open Transport PPP!

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## Other Operating Systems

This sections explains how to configure your modem for:

- Windows 3.x
- MS-DOS
- UNIX, Linux, or AIX

### If You Are Using Windows 3.x

Windows 3.x comes with a built-in communications software package, Windows Terminal. You can use Windows Terminal to test your modem or you can install the communications software package that is included on the *Connections* CD-ROM.

Because Windows Terminal only supports speeds up to 19200 bps, it is recommended that you use a third-party communications software package.

### If You Are Using MS-DOS

Because there is no communications software built in to MS-DOS, you must install and run a third-party communications software package to operate your modem.

RapidComm, which is included on the *Connections* CD-ROM, contains MS-DOS and Windows 3.1 versions of RapidComm.

You must choose the COM port to which your modem is attached in whatever communications software package you are using.

### If You Are Using UNIX, Linux, or AIX

For instructions about how to set up your UNIX®, Linux, or AIX communications software package, see the software's installation procedure.

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# 2 USING THE AT COMMAND SET

This chapter includes information about

- Basic AT commands
- Using S-Registers
- Understanding bit-mapped S-Registers

## Overview

You can use AT commands to change your modem settings at any time.

To send AT commands to your modem, you need to put your communications software in Terminal Mode. In terminal mode, what you type is sent directly to the modem.

### General rules for using AT commands

You must follow some general guidelines to send AT commands to your modem:

- Type AT before each command and press <ENTER> after each command.

*The exceptions are A/, A> and +++, which require neither AT nor <ENTER>.*

- Leave zeroes off the end of AT commands. A missing numeric parameter is assumed to be a zero. For example, ATE is equivalent to ATE0.
- Create compound commands of up to 56 characters between AT and <ENTER>. See the following example.

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**AT&K3X2DT5551234**

| | |
|---|---|
| AT | Attention; a command follows. |
| &K3 | Disable MNP5 data compression; use only V.42 bis compression. |
| X2 | Use the X2 result code subset. |
| DT | Dial the following number using tone dialing. |

*Hyphens and parentheses add to the count of 56 characters but, spaces do not.*

## Basic AT commands

The command AT informs the modem that a command is coming. AT must precede all commands except A/, A> and +++.

| To configure your modem to | Command |
|---|---|
| Re-execute the last-issued command. | **A/** |
| Repeat the last-issued command until canceled by pressing any key. | **A>** |

**Example:** Sending **ATD5551234** will make the modem dial 555-1234. Now, if you send **A/** the modem will dial 555-1234 again.

## Using S-Registers

S-Registers are addresses of places in memory where various timing parameters, redefinitions of selected ASCII characters, and other configuration settings are stored.

Initially, the S-Register settings for each of the NVRAM templates are the same. You can overwrite an S-Register's stored value. See the default values listed in Appendix A, *S-Registers*, for a complete listing of the initial settings.

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## Displaying S-Register settings

You can display S-Registers in a variety of ways. See the table below for more information.

| To display | Command |
|---|---|
| Contents of ONE S-Register | **ATS***r***?**, where *r* is the register's number |
| S-Register settings in the NVRAM templates | **ATI5** |
| S-Register settings in RAM (the current configuration) | **ATI4** |

**Example:** Sending **ATS0?**, displays the contents or setting for S-Register 0.

*When using the commands ATI4 and ATI5, S-Register settings appear as a table seven columns wide, each entry of the form, "Smm=nnn" where mm is a register number between 0 and 70 and nnn is a decimal value between 0 and 255.*

## Setting an S-Register

You can configure each S-Register setting manually.

***CAUTION:*** *If you do not write an S-Register setting with* **&W***, the setting will be retained only until the next reset or power off.*

| To change | Command |
|---|---|
| Settings for a register in the current configuration | **ATSr=n** |

**Example**: Sending **ATS0=2**, changes the setting for S-Register 0 to 2. This setting will cause the Business Modem to answer, in Auto Answer Mode, on the second ring.

In the command ATSr=n, r is the register's number and n is a decimal value from 0-255 (unless otherwise indicated) that specifies the setting.

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### Getting a list of S-Registers

| To display | Command |
|---|---|
| A list of S-Registers | **ATS$** |

*In order to issue this command, you must be in Terminal Mode.*

See Appendix A, S-Registers for a complete list of S-Registers.

## Understanding bit-mapped S-Registers

A bit-mapped S-Register uses one number to describe a collection of settings. Bit-mapping allows us to pack a lot of information in a small space.

Bit-mapped registers are in the form of Sr.b=n, where r is the bit-mapped register; .b is the bit; n is 0 (off) or 1 (on).

See Appendix A, S-Registers to see how bits are mapped into decimal values and for information about setting bit-mapped S-Registers.

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# 3 MODES OF OPERATION

This chapter contains information about

- Command and Online Modes
- Controlling Local Echo
- Data and Fax Modes

## Command and Online Modes

| If you want to | Set the modem to | Use this command |
|---|---|---|
| Control the modem using AT commands. | Command Mode | **+++** (Escape Code) |
| Your modem set to revert to Command Mode when the Escape Code (+++) is used. | | **ATS14.0=0** |
| Your modem to Disconnect when the Escape Code (+++) is used. | | **ATS14.0=1** |
| Return to your connection after an Online Command Mode session. | Online Mode | **ATO0** |
| Send the modem commands while you are on line with another device. | Online Command Mode | **+++** (Escape Code) |

*DO NOT type* **AT** *before* **+++** *or* **<ENTER>** *after the command*

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### Entering Online Command Mode

When the modem is in Online Mode, the only command it recognizes is an escape code, or +++.

Revert to Command Mode without losing connections by sending **ATS14.0=0** to the modem before establishing your connection.

5 Wait one second after sending the last item of data

6 Type **+++**

7 Wait for OK to appear before typing any data

You can change the characters used to revert to Command Mode or the wait time by resetting Register S2 or S12. For more information about resetting these S-Registers, see Appendix A, S-Registers.

### Returning to Online Mode

There are two ways to return online using the ATOn command.

| If you want to | Command |
|---|---|
| Return online | **ATO0** |
| Return online and retrain | **ATO1** |

**Example:** Sending **ATO1**, will allow you to resynchronize if you experienced errors during a non-ARQ data transfer.

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## Controlling Local Echo

There are two local echo settings, one for Command Mode and one for Online Mode.

### Command-Mode Local Echo

You can configure your modem to display the commands you type on screen by using the ATEn command

| If you want the commands you type to | Command |
|---|---|
| NOT appear on screen (Command Mode echo OFF) | **ATE0** |
| Appear on your screen (Command Mode echo ON) | **ATE1** |

*Although you cannot see the command when you set ATE0, the modem is receiving them.*

### Online-Mode Local Echo

To configure your modem to display a copy of data that is being transmitted on your screen you can use the ATFn command.

| As the modem transmits data to a remote system | Command |
|---|---|
| The modem sends a copy of the data to the screen. Online local echo ON ("half duplex"). | **ATF0** |
| No copy of the data is displayed on screen. Online echo OFF ("full duplex"). | **ATF1** (default) |

**Example:** Sending **ATF0** will allow you to see what you are typing in the display window.

*You may see the term duplex used in place of online local echoing, although the term is not technically accurate.*

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## Data and Fax Modes

Once you are in Command Mode, you can initialize the modem in Data or Fax mode.

Fax operations require facsimile-compatible communications software that can send or receive Group III faxes. Follow the instructions in your fax software manual.

*The modems default operating mode is Data Mode. Most fax software automatically switches the device to Fax mode when you run the program, and resets the device to Data mode when you exit the program*

| If you want the modem prepared to | Mode | Command |
|---|---|---|
| Make calls to and receive calls from other modems | Data Mode | **AT+FCLASS=0** |
| Make calls to and receive calls from analog facsimile devices, such as fax modems and fax machines | Fax Mode | **AT+FCLASS=1** (Class 1 Fax Mode) or **AT+FCLASS=2.0** (Class 2.0 Fax Mode) |

**Example:** Sending **AT+FCLASS=1**, allows you to receive faxes from fax machines.

*Class 1 and Class 2.0 Fax Modes refer to standards set by the Electronic Industries Association/Telecommunications Industry Association. Class 1 Fax Mode is the minimal standard for computer-faxmodem interface. Class 2.0 Fax Mode refers to the extended computer-faxmodem interface.*

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If you are not sure whether your modem is in Data or Fax mode, use the **AT+FCLASS?** command

| If the modem returns a value of | This indicates |
|---|---|
| 0 | Data Mode |
| 1 | Class 1 Fax Mode |
| 2.0 | Class 2.0 Fax Mode. |

*Whenever the modem is reset using the ATZ command or by turning the power off and then on, it will reset to Data Mode.*

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# 4 DIALING, ANSWERING, AND HANGING UP

This chapter explains how to use basic AT commands for:

- Dialing
- Carrier loss redial
- Answering calls
- Making International calls
- Call detection
- Caller ID functions
- Distinctive Ring support

## Dialing

You can use your modem to dial the specified phone number and execute dial options by using the following commands.

### Dial options

| For your modem to | Command |
|---|---|
| Dial the specified phone number and execute dial options (DO NOT use spaces or dashes). | **ATD** *phone number* |
| Tone dial. | **ATDT** |
| Pulse dial. | **ATDP** |
| Pause for the length of time specified by S-Register 8. The default is 2 seconds. | **ATD,** (Comma) |
| Pause for 125 milliseconds. | **ATD/** (Slash) |
| Wait for a second dial tone before continuing dialing.<br>This command only works only if the X3 (or higher) command has been issued (see Chapter 7, *Controlling Result Code Displays* and Appendix D, *Result Code Meanings and Sets*). If the modem is set to X2 or lower, it interprets the W as a two-second pause, unless it detects a second dial tone within two seconds. | **ATDW** |

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| For your modem to | Command |
|---|---|
| Wait for an answer (with X3 or higher).<br><br>Some online services answer the phone and return a tape-recorded request for information before processing transactions.<br><br>Use the AT@ command to tell the modem to detect at least one ring, wait for five seconds of silence at the other end of the call, and then continue.<br><br>To use the AT@ command, set the modem to X3, X4 or X7.<br><br>If set X2 or lower, the modem will return an ERROR message when it encounters the @ character. If set to X5 or X6, the modem hangs up when it detects a voice answer. | **ATD@** |
| Return to Command mode after dialing. | **ATD;** (Semicolon) |
| Dial the letters that follow (in an alphabetical phone number). | **ATD"** |
| *If you are including another command after the phone number, use closing quotation marks before the additional command.* | |
| ***IMPORTANT:*** *With the exception of the above Dial options, your modem will ignore any commands issued after the D in the same command string.* | |
| Call a device that can only originate calls. It forces the modem to dial out at the answer frequency or Reverse frequencies. You can put the R either before or after the number. | **ATDR** |
| Display different sets of result codes. See Chapter 6, *Controlling Result Code Displays* and Appendix D, *Result Code Meanings and Sets*. | **ATX2D . . . . . X7D** |
| Dial the last-dialed number. Use ATDL instead of using A/ if you wish to send the modem non-Dial commands before dialing again. | **ATDL** |
| Display the last-dialed number. | **ATDL?** |
| Dial the number stored in nonvolatile random access memory at position *n*, where *n* = 0*9. See Chapter 6, *Working with Memory*, for instructions about saving phone numbers to memory.<br><br>Digits 0 through 9, * and # are accepted. | **ATDS***n* |
| Stop dialing or stop repeating. | Type any key |
| Reissue the last command (Don't type **AT** or press **<ENTER>**). | **A/** |

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| For your modem to | Command |
|---|---|
| Dial a number, wait 60 seconds for a connection, and then hang up. Wait two seconds, then redial. Make a maximum of 10 attempts.<br>To stop the repeating, press any key during the pause between dial attempts. If you press any key while the modem is dialing, that dial attempt is canceled but the cycle will continue | **>** |
| Dial the last-dialed number and repeat it just as the > command does. Also can be used to repeat any command. | **A>** |

## Carrier Loss Redial

You can set the Business Modem to redial the last-dialed number after it loses carrier (carrier is the signal maintained between two modems while they are on line). This feature is useful for dialed-line connections that operate unattended.

| For your modem to | Command |
|---|---|
| Disable carrier loss redial | **ATS69.1=0** |
| Enable carrier loss redial | **ATS69.1=1** |
| Wait *n* seconds between losing the connection and redialing.<br>This command also defines the interval (in seconds) between dialing attempts in the that the first attempt is not successful. | **ATS44=*n*** |

**Example:** Sending **ATS44=20** sets a 20-second interval between losing the connection and redialing.

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## Answering Calls

Your modem can be configured to answer calls. By default, your Business Modem will not automatically answers calls.

### Force Answer Mode

| For your modem to | Command |
|---|---|
| Go through the answer sequence when it hasn't received an incoming call<br>Or<br>Manually answer a call | **ATA** |

### Auto Answer

You can set your modem to Auto Answer using the ATS0 command

| For your modem to | Command |
|---|---|
| Receive calls unattended (Auto answer enabled)<br>Remember to set your communications software to save incoming messages and/or files. | **ATS0=1** (this instructs the modem to answer on the first ring) |
| NOT receive calls unattended (Auto answer disabled) | **ATS0=0** |

**Example:** Sending **ATS0=0** will not allow your modem to receive calls when you are not present.

See the S-Register summary in Appendix A, *S-Registers* for more information about instructing the modem to answer after more than 1 ring.

When your modem senses a call coming in, it sends the result code RING to your computer, goes off hook, and negotiates for a connection. If there is no response within 60 seconds, the Business Modem hangs up.

For more information about adjusting the 60-second wait-for-connection time using S-Register 7, see Appendix A, *S-Registers.*

When a call is disconnected, the Business Modem hangs up and returns the NO CARRIER result code.

*If S0=0, Auto Answer is disabled. To determine if Auto Answer is NOT disabled send the command* **ATI4** *and be sure that S0=1-255.*

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### Hanging up

If you want to end a connection with a remote device do the following:

1. Enter Online Command Mode by typing **+++**
2. Wait 1 second
3. Type **ATH**

## Making International calls

You can use the ATB*n*, AT&G*n* and ATP*n* commands for making analog international calls above 1200 bps.

### Handshaking options

The ATB*n* command controls the handshake options.

| If you want your modem | Command |
|---|---|
| To answer all V.34-type calls, as well as calls from overseas, use ITU-T (formerly CCITT) answer sequence. | **ATB0** (Default) |
| NOT to answer V.34-type calls. Use Bell answer tone. This setting selects HST modulation. | **ATB1** |

**Example:** Sending **ATB1**, will allow your modem to use Bell answer tone (selecting HST modulation).

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### Guard tone

The AT&G*n* command only applies to analog overseas calls at 2400 or 1200 bps.

| To set your modem for | Command | Required in these countries |
|---|---|---|
| No guard tone | **AT&G0** (Default) | United States and Canada |
| 550-Hz guard tone | **AT&G1** | Some European countries |
| 1800-Hz guard tone | **AT&G2** | The U.K. and some Commonwealth countries |

*If you set &G2 you must also send* **ATB0** *to the modem. This setting allows the Business Modem to answer all calls from overseas.*

Make/Break Ratio

The AT&P*n* command sets the off-hook/on-hook (make/break) interval for pulse dialing.

| To set you modem for | Command |
|---|---|
| North American make/break ratio (39/61) | **AT&P0** |
| United Kingdom make/break ratio (33/67) | **AT&P1** |

## Call Detection

Call Detection allows the modem to recognize whether an incoming call is analog data or fax.

Call Detection is an optional Service Class 2.0 feature and is also implemented by 3Com for Fax Class 1 applications.

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## Caller ID Functions

Caller ID is a service provided by local telephone companies. When you subscribe to caller ID, your phone company begins providing you real-time information about incoming calls.

The caller ID signal includes the date and time of the call, the phone number of the calling device, and, optionally, the name of the calling party. The signal is sent between the first and second rings and must be decoded and displayed by a device connected to your phone line. The Business Modem has the ability to decode and display the caller ID information.

### Service Types

You can subscribe to Basic or Extended caller ID service. Basic service offers you the date and time of the call and the calling party's telephone number. Extended service provides the billing name associated with the calling party's telephone number in addition to the Basic service information.

The information the Business Modem actually receives depends on the service type to which you've subscribed, the information that the calling party's telephone company provides, and whether the equipment in between supports caller ID. At minimum, you will always receive the date and time that a call arrived.

If a call arrives without a caller ID signal, the modem will send OUT OF AREA in place of the phone number and name. If the caller ID information has been blocked by the user at the other end, the Business Modem will send PRIVATE in place of the phone number and name.

### Applications of Caller ID Technology

You can use caller ID to screen calls, keep a record of calls, or prevent unauthorized access to your network. Third-party database and telephony applications such as security, call logging, and black-listing applications exploit the caller ID information provided by the Business Modem.

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### How the Business Modem Handles Caller ID

When the modem receives the caller ID signal, it stores the information in memory. You can access the information at any time by sending **ATI15** to the modem.

```
ati15

3Com OfficeConnect 56K Business Modem CID Status…

80 1E 01 08 31 30 31 35 32 30 33 38 02 0A 37 30

38 35 35 35 30 30 30 31 07 0C 55 2E 53 2E 52 4F

42 4F 54 49 43 53 22

DATE = 1015

TIME = 2038

NMBR = 8475550001

NAME = U.S.ROBOTICS

OK
```

Using the #CID command (described below), you can have the Business Modem send the information to your computer between the first and second RING messages. The caller ID information is displayed only once.

```
RING

DATE = 1015

TIME = 2038

NMBR = 8475550001

NAME = U.S.ROBOTICS

RING
```

The information remains in memory until either you reset the modem or until it receives another valid caller ID signal.

*To be sure that the Business Modem receives the caller ID signal when auto-answer is enabled, set S0=2 or higher or make sure your communications software is set to answer on 2 or more rings.*

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## Presentation Formats

The Business Modem sends the caller ID information to your computer formatted or unformatted. Formatted presentation is a translation of the caller ID signal into ASCII text. Unformatted presentation is a hexadecimal representation of the caller ID signal.

An Example of Formatted caller ID presentation:

```
RING


DATE = 1015

TIME = 2038

NMBR = 8475550001

NAME = U.S.ROBOTICS


RING
```

An Example of Unformatted caller ID presentation:

```
RING


801E0108313031353230333802 0A37303835353530303031070C552E532E
524F424F5449435322


RING
```

## Commands

The following table describes the AT#CID=*n* settings.

| Caller ID Action | Command |
|---|---|
| Disable Caller ID detection and reporting | **AT#CID=0** (Default) |
| Enable Caller ID with formatted output | **AT#CID=1** |
| Enable Caller ID with unformatted output | **AT#CID=2** |

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| Caller ID Action | Command |
|---|---|
| Enable Caller ID with formatted output and name suppressed | **AT#CID=3** |
| Enable Caller ID but do not transmit the information to your computer—retain it in the Business Modem's memory | **AT#CID=4** |
| Display the current caller ID setting. | **AT#CID?** |
| Display the Caller ID settings that are available | **AT#CID=?** |

**References**

For more information about Calling Number Delivery (CND), refer to Bellcore documents TR-TSY-000030 and TR-TSY-000031. To obtain Bellcore documents, contact:

Bellcore Customer Service

8 Corporate Place

Room 3A184

Piscataway, NJ 08854-4196

(800)521-2673

## Distinctive Ring Support

Distinctive ring is a service provided by local telephone companies that permits the assignment of multiple phone numbers to one line. Each phone number is associated with a different ring pattern, and devices that recognize distinctive ring, like the Business Modem, can be set to answer only on certain incoming ring patterns.

For example, a fax machine, answering machine, telephone, and modem could all share the same line. Each device would have its own phone number and respond only to calls intended for that number.

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There are four ring patterns in common use:

| Ring | Description |
|---|---|
| A | 1.2 to 2.0 seconds on, 4.0 seconds off. |
| B | 0.8 second on, 0.4 second off, 0.8 second on, 4.0 seconds off. |
| C | 0.4 second on, 0.2 second off, 0.4 second on, 0.2 second off, 0.8 second on, 4.0 seconds off. |
| D | 0.3 second on, 0.2 second off, 1.0 second on, 0.2 second off, 0.3 second on, 4.0 seconds off. |

These are graphical depictions of each ring pattern.

## Commands

| For your modem to | Command |
|---|---|
| Enable recognition of Ring A | **ATS70.0=1** |
| Disable recognition of Ring A | **ATS70.0=0** |
| Enable recognition of Ring B | **ATS70.1=1** |
| Disable recognition of Ring B | **ATS70.1=0** |
| Enable recognition of Ring C | **ATS70.2=1** |
| Disable recognition of Ring C | **ATS70.2=0** |
| Enable recognition of Ring D | **ATS70.3=1** |
| Disable recognition of Ring D | **ATS70.3=0** |

**Example:** Sending **ATS70.0=1.3=1** to your modem enables the recognition of ring types A and D only.

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When a call comes in with a ring type A or D, the Business Modem will send the result code RING A or RING D, respectively. The Business Modem will ignore other ring types.

If S70 is set to 0 (the default) the Business Modem detects ring types A and B, sending the result code RING for either ring type. This function is identical to that of other 3Com modems that do not support distinctive ring.

If only one ring type is enabled, the Business Modem will recognize only the enabled ring type and ignore all others. It will send the result code RING only when it detects the ring type that's enabled.

If more than one ring type is enabled, the Business Modem will recognize only the enabled ring types and ignore the others. When a call arrives, the Business Modem will send its ring type in the result code, for example, RING C.

### Result Codes

| Verbal | Numeric |
|---|---|
| RING A | 170 |
| RING B | 171 |
| RING C | 172 |
| RING D | 173 |

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# 5 WORKING WITH MEMORY

This chapter contains information about:

- Saving a phone number to NVRAM
- Working with Flash Memory

*You can upgrade the software held in Flash memory by performing a software download.* See Chapter 3*, Upgrading your Software,* for more information about performing a software downloads.

## Overview

Business Modems contain three types of memory that you can interact with: random access memory (RAM), nonvolatile random access memory (NVRAM), and Flash memory.

| Memory type | Applies to | Loss of power will | Command |
|---|---|---|---|
| RAM | The current settings. | Cancel any changes you make. To save settings before resetting the modem, use &W. See the section *Working with RAM* for more detailed information. | **ATI4** |
| NVRAM | Saved settings (any configurations you can store, retrieve, and change). | NOT affect your settings. | **ATI5** |
| Flash | Three templates of permanent settings (the Business Modem's operating software). | NOT affect your settings. You can retrieve the permanent settings, and save them to NVRAM, but you cannot alter them. | Not applicable. |

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**Example:** Sending **ATI5** will display NVRAM settings on your screen.

*To see a complete listing of the permanent settings stored in Flash memory see* Appendix C*, Flow Control Templates.*

### Working with RAM and NVRAM

You can change any setting just for the current session. For example setting your Business Modem to **AT&N8** will only allow a connection to a remote devices at a rate of 14400 bps until the modem is reset. Once the modem is reset, the default variable connection rate will be re-established.

If you want the new setting to be a default, write it to NVRAM at the same time. From the example above, you would send **AT&N8&W** to the modem. The new default setting for your Business Modem will only allow a 14400 bps connection to a remote device.

*To restore NVRAM factory defaults use the AT&Fn command. See Appendix B,* Alphabetic Command Summary*, for more information on setting &Fn.*

## Saving a Phone Number to NVRAM

| For your modem to | Command |
|---|---|
| Write the phone number (*s*) to a position (*n*) in memory. You can store up to 10 phone numbers of up to 40 characters each in positions 0-9. | **AT&Z***n*=*s* |
| Display the number stored in the last-dialed number buffer | **ATDL?** |
| Display the phone number stored in NVRAM at position n, where n = 0*9. | **AT&Z***n***?** |

***CAUTION:*** *Do not include modem commands in* **AT&Z***n*=*s.*

**Example:** To store the phone number 555-6789 at position 2, type **AT&Z2=555-6789**. If you want to dial the phone number you saved, type **ATDS2**.

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If the call requires a special setting, insert it in the command before the DSn command. In this example, &M0 (no error control) comes before DS2. Type: **AT&M0DS2**

*The AT&Zn=s command functions differently when Dial Security is enabled. See Chapter 11,* Dial Security*, for more information.*

### Displaying S-Register Value Information

| For your modem to | Command |
|---|---|
| View the contents of a particular S-Register | **ATS***r***?** (where *r* is the number of the S-Register) |

**Example:** Sending **ATS0?** will allow you to view the contents of Register S0.

### Saving a Command String to NVRAM

| For your modem to | Command |
|---|---|
| Store a command string in NVRAM. The command string can be up to 30 characters long; spaces do not count. This command is used so that you can call another modem without loading your communications software. | **AT&ZC=***string* |
| Display the stored command string | **AT&ZC?** |

## Working with Flash Memory

The Business Modem permanently stores three configuration "templates," or prepared sets of commands, in Flash memory. You can use the &Fn command to load one of the three configuration templates from Flash memory into current memory.

| To load this configuration template into current memory | Command |
|---|---|
| No flow control (low performance). | **AT&F0** |
| Hardware flow control. | **AT&F1** |
| Software flow control. | **AT&F2** |

**Example:** Sending **AT&F1** to your modem will load the Hardware Flow Control Template into RAM Memory.

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All of the settings in each template are given in Appendix C, *Flow Control Templates.*

For more information about hardware and software flow control, See Chapter 12, *Flow Control*.

### Saving ROM Templates to NVRAM

To save one of the three ROM templates to NVRAM and have it serve as the reset default, enter **AT&F*n*&W**

### Default Settings

When the Business Modem is turned on it loads the settings stored in NVRAM. By default, these settings are that same as the &F1 template.

You can save any of the three templates, or save modified versions of them, in NVRAM for use as power-on defaults.

| For your modem to | Command | Example |
|---|---|---|
| Display NVRAM settings (&F1 settings) | **ATI5** | **ATI5** |
| Substitute a template (other than &F1) | **AT&F2&W** (Default) | **AT&F2&W** |
| Save modified versions of the settings to NVRAM | **AT**<settings>**&W** | **ATS10=40&A2&W** |

See Appendix C, *Flow Control Templates* for a complete listing of the default values.

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# 6 CONTROLLING RESULT CODE DISPLAYS

This chapter contains information about:

- Result Code Display commands
- Additional Result Code subsets

## Result Code Display Commands

The commands listed below control whether result codes are displayed, and in what format they are displayed

| If you want the modem to | Command |
|---|---|
| Display result codes. | **ATQ0** |
| NOT display result codes. | **ATQ1** |
| NOT display result codes while in Answer mode. See Chapter 4, *Modes of Operation*, for a description of modes. | **ATQ2** |
| Display result codes in numeric form. | **ATV0** |
| Display result codes in verbal form. | **ATV1** |
| Display result codes when originating, answering, and retaining a call. | **ATS14.1=0** |
| Display result codes ONLY when originating a call | **ATS14.1=1** |
| Display sets of result codes. See Appendix D, *Result Code Sets and Meanings*. | **ATX***n*<br>(Default ATX7) |

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## Additional Result Code Subsets

*ARQ (Automatic Repeat Request) is used in this manual to denote calls that use error control.*

| For your modem to | Command |
|---|---|
| Display only connection rate. | **AT&A0** |
| Display connection rate and ARQ result codes. | **AT&A1** |
| Display connection rate, ARQ result code, and protocol information (V32, VFC, V34, or x2/v.90). If your software cannot handle the added protocol information, select &A1 or &A0. | **AT&A2** |
| Display connection rate, ARQ result code, protocol, error control (LAPM, MNP, or NONE), and data- compression type (V42BIS, MNP5) indicators. | **AT&A3** (Default) |

*The numeric identifiers for &A3 result codes are the same as those used for &A2. If you request numeric display (V0) and &A3, you won't be able to distinguish &A2 from &A3 codes.*

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# 7 CONTROLLING EIA-232 SIGNALING

This chapter contains information about configuring the EIA-232[1] signalling between your computer and modem:

- Data Terminal Ready
- Data Set Ready
- Carrier Detect

## Data Terminal Ready

Your computer sends a Data Terminal Ready (DTR) signal to the Business Modem when it is ready to send and receive data. The &Dn command tells the modem how to respond to the DTR signal.

| For your modem to | Command |
|---|---|
| Ignore the state of DTR and act as if DTR is always present. Use this command with equipment that cannot provide DTR. | **AT&D0** |
| If issued *before connecting with another device*, enter online Command Mode during a call by dropping DTR. Most communications software packages have a method for toggling DTR. Refer to your software's manual for details. | **AT&D1** |
| Respond normally to the DTR signal.<br>The Business Modem will not accept commands until your computer sends a DTR signal. The call will end when the DTR signal is dropped.To change the DTR recognition time, set S-Register 25. See Appendix A, *S-Registers* for more information. | **AT&D2** |
| Business Modem hangs up and resets upon loss of DTR signal. | **AT&D3** |

**Example:** Sending **AT&D1** before connecting with another device, dropping DTR will enter Command Mode.

1.The EIA-232 Standard was formerly known as RS-232 (RS stands for Recommended Standard).

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## Data Set Ready

Under normal conditions, the Business Modem sends a Data Set Ready (DSR) signal to your computer when it is ready to send and receive data.

***CAUTION:*** *Do not change the default setting of &S0 unless you know that your installation requires a different setting. Few Windows communications programs, if any, will require the Business Modem to control DSR (&S1).*

Use the following command to control how the modem sends the DSR signal.

| For you modem | Command |
|---|---|
| To send the DSR signal at all times. | **AT&S0** (Default) |
| When originating a call, to send the DSR signal after dialing when the Business Modem detects the remote analog device's answer tone | **AT&S1** |
| When answering a call, to send DSR after the Business Modem sends its answer tone. | **AT&S1** |
| After sending Carrier Detect (CD), to send a pulsed DSR signal, followed by a Clear to Send (CTS) signal. Use this option for specialized equipment such as automatic callback units. | **AT&S2** |
| After sending Carrier Detect (CD), to send a pulsed DSR signal. | **AT&S3** |
| To send a DSR signal to your computer at the same time the Business Modem sends the CD signal. | **AT&S4** |
| To send DSR normally (with CTS) after sending CD.<br>In order to change the DSR pulse time (in 20-second increments), set S-Register 24. (See Appendix B,*Alphabetic Command Summary*). | **AT&S5** |

**Example:** Issuing **AT&S3** configures the Business Modem to send a pulsed DSR signal after sending the Carrier Detect (CD) signal.

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## Carrier Detect

Carrier means there is communication with the device on the other end of the connection. Under normal conditions, the Business Modem sends a Carrier Detect (CD) signal in response to establishing a connection with another modem. You can use the AT&C*n* command to control how the Business Modem sends the CD signal.

| For your modem to | Command |
|---|---|
| Have CD always ON. | **AT&C0** |
| Send CD normally (the Business Modem sends a CD signal when it connects with another device, and drops the CD signal when it disconnects). | **AT&C1** |

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# 8 CONTROLLING DATA RATES

This chapter contains information about

- Serial port rates
- Connection rates
- Controlling Link Speeds with &N and &U
- Setting DTE Rate to 230 Kbps

## Overview

You can set the Business Modem to use fixed or variable serial port rates and fixed or variable connection rates. Serial port rates pertain to data transferred between your computer and the Business Modem. Connection rates pertain to data transferred between the Business Modem and the device at the other end of a connection.

## Serial Port Rates

You set a fixed serial port rate to get the highest possible throughput and the best performance. Set a variable rate to allow the Business Modem to match the connection rate.

Your software must support fixed or variable serial port rates.

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*Your software may use terms such as locked serial port (fixed rate) or autobaud (variable rate).*

| To allow your modem | Set the serial port rate as | Command |
|---|---|---|
| To change its serial port rate to match the connection rate. | Variable | **AT&B0** |
| To always communicate with an attached device at the rate at which you have set the terminal or software, regardless of the connection rate.<br>For the greatest throughput, set the serial port to 115200, 57600, or 38400 bps for high-speed calls, and to at least 9600 bps for 2400-bps calls. | Fixed | **AT&B1** (Default) |
| To shift its serial port rate to a rate that you specify using your communications software (for example, 38.4 Kbps) when the Business Modem connects in ARQ mode.<br>If the connection is not under error control, the Business Modem behaves as if it was set to &B0 and switches its serial port rates to match the connection rate of each call.<br>To implement this feature, first set your software to the desired rate. Then send **AT&B2&W** to the modem.<br>The Business Modem stores the rate of the command in NVRAM along with the current settings. The Business Modem checks NVRAM for the specified serial port rate each time it makes an ARQ connection.<br>When saving subsequent configurations to NVRAM, be sure your software is set to your selected serial port rate so the correct rate is maintained. | Fixed for ARQ calls<br>and<br>Variable for non-ARQ calls when answering only.<br>See Chapter 13, *Handshaking, Data Compression, and Error Control, for more information about ARQ* | **AT&B2** |

*The serial port rate MUST be equal to or higher than the Connection rate (&Nn).*

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## Connection Rates

You can set the Business Modem to a fixed or variable connection rate for data calls. Set a variable rate to have the Business Modem negotiate with the remote device for the highest possible connection rate. Set a fixed rate to connect only at a specified rate. You might use a fixed rate to filter calls for security or other reasons.

| To allow your modem to | Set connection rate as | Command |
|---|---|---|
| Negotiate for the highest possible rate. | Variable | **AT&N0** |
| Connect only if the remote device is operating at the rate you specify. See below. | Fixed | **AT&N1-AT&N16** |

| To connect at this rate | Command | To connect at this rate | Command |
|---|---|---|---|
| 300 bps | **AT&N1** | 16.8 Kbps | **AT&N9** |
| 1200 bps | **AT&N2** | 19.2 Kbps | **AT&N10** |
| 2400 bps | **AT&N3** | 21.6 Kbps | **AT&N11** |
| 4800 bps | **AT&N4** | 24.0 Kbps | **AT&N12** |
| 7200 bps | **AT&N5** | 26.4 Kbps | **AT&N13** |
| 9600 bps | **AT&N6** | 28.8 Kbps | **AT&N14** |
| 12.0 Kbps | **AT&N7** | 31.2 Kbps | **AT&N15** |
| 14.4 Kbps | **AT&N8** | 33.6 Kbps | **AT&N16** |

**Example:** Sending **AT&N8** will only allow connections with remote devices that are operating at 14.4 Kbps.

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## Controlling Link Speeds with &N and &U

You can use the &N and &U commands to control link speeds.

### Controlling Link Speeds

Use the following table to determine how to use &N and &U commands:

| To limit the | Use |
|---|---|
| Highest possible connect speed | **AT&N** |
| Lowest possible connect speed | **AT&U** |
| Range of possible connect speeds | **AT&N** and **AT&U** |

*The default values for &N and &U are 0. If you change these values, you will limit the speeds at which you can connect. 3Com recommends that you do not alter these values.*

### Limiting the Highest Possible Connect Speed

The &N command, when used in conjunction with the &U command, allows you to limit the highest possible connect speed. If a remote modem attempts to connect to your Business Modem at a speed higher than &N, your Business Modem will not allow it to connect.

| To limit the | Use this command | Where x is |
|---|---|---|
| Highest possible connect speed | **AT&N=x** | A value from 0 to 32 |

*For a complete list of connect speeds, see the table in section* &N and &U Command Values.

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### Limiting the Lowest Possible Connect Speed

The &U command allows you to limit the lowest possible connect speed. If a remote modem attempts to connect to your Business Modem at a speed lower than &U, your Business Modem will not allow it to connect.

| To limit the | Use this command | Where x is |
|---|---|---|
| Lowest possible connect speed | **AT&U=x** | A value from 0 to 32 |

*See the table in the section* &N and &U Command Values *for connect speed values.*

### Limiting a Range of Possible Connect Speeds

By setting &N and &U values, you can limit the range of speeds at which your Business Modem connects. If a remote modem does not connect to your Business Modem at a range between the speeds designated by the &N and &U commands, your Business Modem will not allow it to connect.

*The link speed associated with the &U argument CANNOT be greater than the link speed associated with &N argument.*

Use the following table to understand the relationship between &U and &N commands:

| If &U | And &N | Then your modem |
|---|---|---|
| Equals zero | Equals zero | Connects at the highest possible speed. |
| Equals zero | Is greater than zero | Connects at the &N speed only. |
| Is greater than zero | Is greater than zero and greater than &U | Connects at the highest possible speed in the range from &U to &N. |

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**&N and &U Command Values**

Use the following table for a complete list of &N and &U link speeds and their associated indexes:

| Link Speed | Index |
|---|---|
| Highest | 0 |
| 300 | 1 |
| 1200 | 2 |
| 2400 | 3 |
| 4800 | 4 |
| 7200 | 5 |
| 9600 | 6 |
| 12000 | 7 |
| 14400 | 8 |
| 16800 | 9 |
| 19200 | 10 |
| 21600 | 11 |
| 24000 | 12 |
| 26400 | 13 |
| 28800 | 14 |
| 31200 | 15 |
| 33600 | 16 |
| 28000 | 17 |
| 29333 | 18 |
| 30666 | 19 |
| 32000 | 20 |
| 33333 | 21 |
| 34666 | 22 |
| 36000 | 23 |
| 37333 | 24 |
| 38666 | 25 |
| 40000 | 26 |
| 41333 | 27 |
| 42666 | 28 |
| 44000 | 29 |
| 45333 | 30 |

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| Link Speed | Index |
|---|---|
| 46666 | 31 |
| 48000 | 32 |
| 49333 | 33 |
| 50666 | 34 |
| 52000 | 35 |
| 53333 | 36 |
| 54666 | 37 |
| 56000 | 38 |
| 57333 | 39 |

## Setting DTE Rate to 230 Kbps

The DTE rate of your Business Modem has been increased to 230 kbps to enhance throughput.

*This command is only supported on Business Modems attached to high speed serial cards.*

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# 9 Accessing and Configuring the Business Modem Remotely

This chapter contains information about:

- Setting up remote access
- Accessing the host
- Quitting a remote access session

## Overview

You can set up the Business Modem so other devices can view or change its configuration remotely.

You should be familiar with these terms before you continue:

| | |
|---|---|
| Local | The device that is directly connected to the computer you are using. |
| Remote | The device at the other end of a telephone connection. |
| Host | The Business Modem that will be accessed and controlled by other devices. |
| Guest | The device that will access and control the host Business Modem. |

## Setting Up Remote Access

### At the Host Business Modem

1 Prepare to send AT commands by putting your communications software in Terminal Mode.

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**2** Enable remote access.

Set Register S41 for a value of 1 or greater. S41 sets the number of log-in attempts available to the remote user. A setting of zero allows no log-in attempts disabling remote access.

**Example:** Sending **`ATS41=1&W`** allows for 1 log-in attempt by a remote user.

**3** Set one or two remote-access passwords.

You can set two passwords to allow different levels of access to each Business Modem

| To allow guest users to | Use this command to assign a remote-access password |
|---|---|
| *View* the Business Modem's configuration. | **`AT%P0=`***password* |
| *View* and *change* the Business Modem's configuration. | **`AT%P1=`***password* |

**Example:** Sending **`AT%P1= corn`** will allow a remote user to log-in with the password *corn*. The user can view and change the Business Modem's configuration.

*Remote-access passwords can be up to eight alphanumeric characters long, and are not case-sensitive*

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### Other Remote-Access Commands

The table below is a list of remote-access configuration commands.

| For your modem to | Command |
|---|---|
| Display a view-only password | **AT%P0?** |
| Display a view-and-change password | **AT%P1?** |
| Erase a view-only password | **AT%P0=** |
| Erase a view-and-change password | **AT%P1=** |
| Disable remote access entirely | **ATS41=0** |

**Example:** Sending **AT%P1=** will erase the view and change password.

***WARNING:*** *If you erase the%P1 password without disabling remote access (using* **ATS41=0***), anyone could access the Business Modem and change its configuration.*

## Accessing the Host

### At the Guest Device

The guest device requires no configuration to access the host. Follow these steps:

1. Be sure that the host device has enabled remote access and is set to auto-answer (**ATS0=1**). Know the password, if you will need one.
2. Call the host device (although it doesn't matter which device originates the call).
3. After a connection is established, do this:
   - **a** Pause 4 seconds.
   - **b** Type 4 tildes: ~~~~
   - **c** Pause 4 seconds.

*The administrator of the host device can change the remote-access character using S-Register 42, and the pause duration using S-Register 43. See Appendix A,* S-Registers *for more information.*

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4 You should see a display similar to this:

```
3Com OfficeConnect 56K Business Modem Remote Access Session
Serial Number 000000A000000001


Password (Ctrl-C to cancel)?
```

There is a 3-minute time limit for entering the password. If the number of unsuccessful log-in attempts exceeds the set limit, the host device returns online and refuses any further log-in attempts during the remainder of the connection.

When the host accepts the password, the following message and prompt will appear on your screen:

```
Remote Access granted

Remote->
```

*You may not be prompted for a password. If you aren't, password security is not active. The following prompt appears on your screen after you type the four tildes:*

```
Remote Access granted (query only)

Remote->
```

*During a remote-access session, the maximum number of characters between carriage returns is 40.*

## Viewing and Changing the Host's Configuration

Once you've gained guest access to a host, you can communicate with the host just as if you were entering commands from its attached computer.

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Depending on your access privileges, you can use the regular set of Business Modem AT commands.

| If you have this access privilege | You can use |
|---|---|
| View-only | Any of the inquiry (ATI) commands |
| View and Configure | Any of the Business Modem commands, except those that cannot be used while online (for example, ATD or ATA). You can also use remote configuration commands.<br>See the next section for examples. |

***CAUTION:*** *Be careful not to send* **ATZ** *or* **ATZ!** *or you will lose the connection!*

## Remote Configuration Commands

There are special commands that can be used only during a remote-access session.

You can change the host Business Modem's serial port rate by using the AT%B*n* command.

| To change the host Business Modem's serial port rate to | Command | To change the host Business Modem's serial port rate to | Command |
|---|---|---|---|
| 110 bps | **AT%B0** | 9600 bps | **AT%B6** |
| 300 bps | **AT%B1** | 19200 bps | **AT%B7** |
| 600 bps | **AT%B2** | 38400 bps | **AT%B8** |
| 1200 bps | **AT%B3** | 57600 bps | **AT%B9** |
| 2400 bps | **AT%B4** | 115200 bps | **AT%B10** |
| 4800 bps | **AT%B5** | | |

**Example:** Sending **AT%B6** will change the Business Modem's serial port rate to 9600 bps.

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You can use the AT%Fn command to control the data format.

| To change the data format to | Command |
|---|---|
| No Parity (8 data bits) | **AT%F0** |
| Mark parity (7 data bits) | **AT%F1** |
| Odd Parity (7 data bits) | **AT%F2** |
| Even parity (7 data bits) | **AT%F3** |

You can use the AT%C*n* command to control whether and when to apply changes to the configuration

| For your modem to | Command |
|---|---|
| Defer configuration changes to when the call ends. | **AT%C0** (Default) |
| Restore the original configuration.<br>Use this command to cancel any changes made during remote access and restore the original configuration. | **AT%C1** |
| Force configuration changes.<br>Use this command to make configuration changes take effect immediately. We do not recommend forcing changes unless it is absolutely necessary because an unreliable connection, or even a loss of connection, may result. | **AT%C2** |

**Example:** Sending **AT%C1** will cancel any changes made to the modem during a remote access session and restore it to the original configuration.

*Even though, by default (%C0), the changes you make do not take effect until the next connection, the new configuration is reflected immediately in inquiry responses (ATIn).*

*Commands that have been written to NVRAM (using &W) and forced configuration changes (%C2) will not be restored to their previous settings when you send the host AT%C1.*

After you make changes to the host's configuration, the remote- access prompt changes from `Remote->` to `Remote+>`.

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If you restore the original configuration using the AT%C1 command, the first prompt is restored, assuring you the original configuration is intact.

## Quitting a Remote-Access Session

If you want to quit the remote-access login *before* you have entered the password, return online by pressing <Ctrl>C or typing ATO.

*After* you've entered the password, you can quit by sending one of these commands:

| To end the remote-access session | Command |
|---|---|
| And keep the connection. | **ATO** |
| And end the connection. | **ATH** |
| End the connection, and reset the host modem. | **ATZ** |

*Before you disconnect, issue the ATI5 command to the remote modem and check its S41 setting. Make sure S41 is set for a value of 1 or greater. If S41 is set to 0, when you disconnect you will not be able to access the remote modem again. To prevent this send ATS41=1&W before you disconnect.*

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# 10 DIAL SECURITY

This chapter contains information about:

- Setting up Dial Security
- Maintaining security accounts
- What the guest user needs to do
- Configuring dial security remotely

## Overview

Dial Security is designed to protect networks and data centers from unauthorized access.

You should be familiar with these terms before you continue:

| | |
|---|---|
| Local | The device that is directly connected to the computer you are using. |
| Remote | The device at the other end of a telephone connection. |
| Host | The Business Modem that will be accessed and controlled by other devices. |
| Guest | The device that will access and control the host Business Modem. |

You can configure up to 10 accounts: one administrative account for you and nine accounts for guest users. The account profiles are stored in the host Business Modem's nonvolatile random access memory (NVRAM).

There are two forms of Dial Security; each will be explained later in this chapter:

- Autopass
- Password Prompting

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## Setting up Dial Security

Here is a summary of the steps for setting up Dial Security:

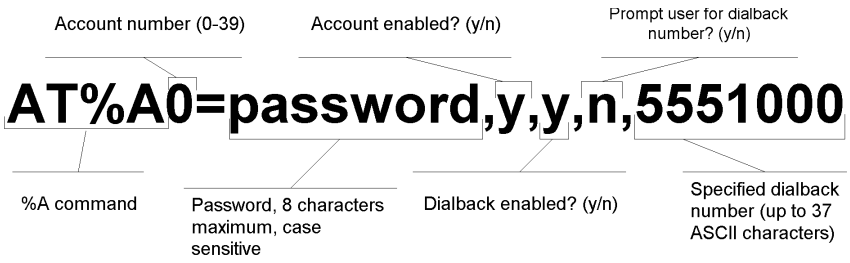
- Set up an account for yourself.
- Identify your account as the Administrative Account.
- Set up guest-user accounts.
- Enable local (host) security.
- Choose a Dial Security method.
- Enable Dial Security.
- Activate the Dial Security settings.

**1** Set up an account for yourself.

Use any of the 40 available accounts (numbered 0-39) for your account.

Use the AT%A*n* command to set up user accounts. See the figure below for the five fields to concern yourself with.

*The AT%An command is automatically written to NVRAM. It does not require you to send &W.*


Account number (0-39)
Account enabled? (y/n)
Prompt user for dialback number? (y/n)
AT%A0=password,y,y,n,5551000
%A command
Password, 8 characters maximum, case sensitive
Dialback enabled? (y/n)
Specified dialback number (up to 37 ASCII characters)

***WARNING:*** *Do not insert spaces between commas or between fields and commas. Spaces will invalidate the command.*

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**Dialback options** You can set the Business Modem to automatically dialback a certain number after a client modem dials in.

*Count your commas! There should always be four commas in the %A command.Do not insert spaces between commas or between fields and commas. Spaces will invalidate the command.*

| To make the host Business Modem | Command | Example |
|---|---|---|
| Hang up and then dial back a guest device at a specified number.<br><br>Expect a pause of approximately 1.5 minutes before the modem dials back. You cannot alter the duration of the pause. | **AT%A0=***password***,y,y,n,1** *area code and phone number* | **AT%A0=corn,y,y,n,1,8475555555** |
| Prompt you to enter a number at which to dialback a device, and then have the Business Modem dialback the device at that number | **AT%A0=**password**,y,y,y,** | **AT%A0=corn,y,y,y,** |
| Disable dialback | **AT%A0=**password**,y,n,,** | **AT%A0=corn,y,n,,** |

*To enable Dialback, you must enable Dial Security with Prompting. See step 6.*

**2** Identify your account as the Administrative Account

| For your modem to | Command | Example |
|---|---|---|
| Identify your account as the Administrative Account | **AT%L** | **AT%L=PW0**<br><br>This example sets account 0 as the Administrative Account. |

Once you set the administrative password, you cannot view or modify the guest account profiles unless you enter the correct administrative password.

***WARNING:*** *Be sure to remember your administrative password. If you enable Dial Security and then forget your administrative password, you*

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*will be locked out of the Business Modem's dial security features. You will need to restore the factory defaults. This will erase ALL passwords and you will have to reconfigure all your accounts.*

**3** Set up guest-user accounts.

Use the AT%A*n* command to set up guest-user accounts in the same way you set up your administrative account. You can set up nine guest accounts. Refer to the figure in step 1 regarding information about formatting the AT%A*n* command.

After you have enabled the guest accounts, make sure the guest users know their passwords and the log-in procedure.

## Modifying Accounts

After you have set up an account, you can modify each field independently. If a field is to remain unchanged from its original setting, just insert a comma, as shown: **`AT%A1=,,,Y,`**

The command above allows the guest user to supply a dialback number that is different from the one stored in the original account record.

**4** Enable Local Security.

***WARNING:*** *If you do not enable Local Security, the Dial Security settings will not be protected and other users will be able to change or erase them.*

| For your modem to | Command |
|---|---|
| Protect the administrative password (local security enabled) | **`ATS53.2=1`** |

*You must use the &W command to save the settings in NVRAM. If you don't, the next time you reset or power off the Business Modem, Dial Security will be disabled.*

**5** Decide which Dial Security option to use.

You can choose from the two types of Dial Security: Autopass and Password Prompting.

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### Autopass Prompting

Autopass is the default form of password protection. Autopass automates the process of logging in to the host modem, but it requires the guest and host devices to be Business Modems.

When a guest device attempts an Autopass connection, the guest includes its password in its V.42 error-control request. The host modem checks all the enabled passwords in its security accounts for a match.

### Password Prompting

Password Prompting allows connections with *any* guest device, as long as the guest user knows the correct password.

When the host has Password Prompting enabled, it asks guest users for a password. The host modem checks the received password against each of its active Security accounts.

The table below is a comparison between Autopass and Password prompting.

| When using Autopass Prompting | When using Password Prompting |
|---|---|
| Both the host and guest devices are made by 3Com and have Dial Security enabled. | Guest devices don't have to support 3Com Dial Security. |
| The connection between the Business Modems or modems is under V.42 error control (See Appendix B, Alphabetic Command Summary for information about using **AT&M4** or **AT&M5**) | V.42 error-control connections aren't required |
| If the guest includes an invalid password, the host sends an INVALID PASSWORD message and hangs up. | If the guest sends an invalid password, the host prompts twice more before disconnecting.<br>If the guest does not send a password after 60 seconds, the host disconnects. |
| If the guest includes a valid password, the host permits a secure connection. | The host will still always respond to a correct Autopass attempt. |
| If the guest did not enable Dial Security, the host will not accept the call unless prompting is enabled on the host Business Modem. | |

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6 Enable Dial Security.

***WARNING:*** Before you enable Dial Security, you must set up an administrative account and password. See Steps 1 & 2.

| For your modem to enable | Command |
|---|---|
| Autopass Dial Security | **ATS53.0=1** |
| Dial Security with Password Prompting (this also enables Autopass) | **ATS53.0=1.1=1** |
| Dialback Security, enable Password Prompting and enable Dialback in each guest account | **AT%A***n*=*password*,**y,y,y,***phone number*<br>where *n* is the account number<br>See the figure in previous section, *Setting Up Dial Security* for more information. |

**Example:** Issuing **AT%A3=corn,y,y,y,5551234** to your modem will enable Password Prompting and Dialback for account 3, which has the password *corn*.

*You must use the &W command to save the settings for Enabling Autopass Dial Security and Dial Security with Password Prompting. If you don't, the next time you reset or power off the Business Modem, Dial Security will be disabled.*

If you need a reference when setting these command, you can use the ATI10 command. See Appendix B, Alphabetic Command Summary for more information about the ATI10 command.

7 Send **ATZ** or **ATZ!** to activate the Dial Security settings!

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## Maintaining Security Accounts

Once the administrative password is set and Dial Security is enabled, the administrator is the only one who can access account information.

You can use the AT%S= and AT%E= commands to change and modify account information.

| For your modem to | Command |
|---|---|
| Access accounts by disabling local security | **AT%S=***administrative password* |
| View account information, once access has been granted. Remote users may only use this command during remote-access sessions if local-access security is disabled. | **ATI10** |
| Erase local-access password | **AT%E=1** |
| Erase Autopass password | **AT%E=2** |
| Erase passwords in accounts 0-9 | **AT%E=3** |
| Erase phone numbers in accounts 0-9 | **AT%E=4** |
| Disable Account, Dialback, and New Number fields in accounts 0-9. | **AT%E=5** |
| Edit or overwrite an individual account or an individual account field | **AT%A***n***=**<br>where *n* is the account number (see the figure in previous section, *Setting Up Dial Security* for more information) |
| Reset &F settings and disbale password protection | Press the RESET button on the back of the modem when offline (same as **AT&FS53=0**) |

**Example:** Sending **AT%E=3** erases passwords for accounts 0-9.

*When using the AT%S= command, the device echoes the administrative password, which is case-sensitive. Business Modems will accept an invalid password entry, but will lock out users from the security commands.*

*For example, if the password is Green, but you enter GREEN, an OK is displayed. However, if you try to type a security command (for example, ATI10 to view accounts), an [ACCESS DENIED] message is displayed.*

## Remote Configuration

Dial Security accounts may be configured remotely. (See *Configuring Dial Security Remotely* at the end of this chapter.)

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## What the Guest User Needs to Do

When guest users want to call in to the host (assuming you have enabled Dial Security by entering **ATS53.0=1**),

- They must know the password.
- If you have enabled Dialback, they must set their device to auto-answer.

**1** If the host has security enabled, get a password from the host's administrator. The password is case-sensitive, so be sure to copy it correctly.

If the host has prompting enabled and the host operator enables Dialback for your account, skip to Step 3.

**2** For guest users with Business Modems:

**a** Create a security account using the password the host's administrator asked you to use. (See *Setting Up Dial Security*, earlier in this chapter, for instructions.)

**b** You need to assign the password as your Autopass password.

| For your modem to | Command |
|---|---|
| Assign the password as your Autopass password | **AT%V=PW***n*, where *n* is the number of the account you set up. |

**Example:** Sending **AT%V=PW3** will assign the password as an Autopass password for account 3.

**c** Check to see that you set your Autopass password correctly by using the ATI10 command.

Your Autopass password appears beside AUTOPASS PASSWORD, if you have done all the steps correctly.

**d** Once the Autopass password is set, enable your Business Modem's Dial Security.

| For your modem to | Command |
|---|---|
| Enable Dial Security | **ATS53.0=1** |

***CAUTION:*** *If you do not follow an S-Register setting with &W, the setting will be retained only until the next reset or power off.*

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3 If Dialback is enabled at the host Business Modem's site, set your modem to answer the host Business Modem when it dials back.

| For your modem to be set | Command |
|---|---|
| To answer the Dialback call | **ATS0=1** |

4 Call the host.

5 After the call ends you can disable Auto Answer.

| For your modem to | Command |
|---|---|
| Disable Auto Answer | **ATS0=0** |

## Configuring Dial Security Remotely

The host administrator can configure the host's security settings remotely.

*At the host device, you must have previously enabled remote access and assigned a remote-access password that allows view-and-change privileges (see Chapter 10, Accessing and Configuring the Business Modem Remotely). You may want to use your administrative password as your remote-access password.*

### Dialing In From the Remote Site

1 From the remote site, connect to the host using Dial Security. Once a connection is made, follow the instructions for beginning a remote-access session as described in Chapter 10, *Accessing and Configuring the Business Modem Remotely*.

2 When remote access has been granted, use the AT%S= command to access the Dial Security accounts. See *Maintaining Security Accounts* section earlier in this chapter.

To view the security account information use **ATI10**.

3 Make any configuration changes and execute them immediately by entering **AT%C2**.

4 To end the remote session and reactivate Dial Security on the host, reset the host device by issuing **ATZ**.

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***WARNING:*** *If you do not use the ATZ command to end a remote-access session, Dial Security will remain disabled at the host, and anyone dialing in to the host for remote access will have access to the ATI10 screen and all Dial Security accounts.*

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# 11 FLOW CONTROL

This chapter contains information about

- Hardware and software flow control
- Received-data flow control
- Transmit-data flow control

## Overview

The Business Modem has two buffers, one for data transmitted from your computer, and one for data received from the phone line.

Flow control provides a system for stopping and starting transmission depending on how full the buffers are. Flow Control's purpose is to prevent overfilling the buffers, which may cause data to be lost.

*We recommend that you use hardware flow control. If you do, depending on your communications software, you will also need to enable hardware flow control in your communications software.*

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## Hardware and Software Flow Control

There are two kinds of flow control: hardware and software. Business Modems support both, but your computer and communications software must also support the kind of flow control you choose.

### Hardware Flow Control

Business Modems implement hardware flow control by detecting that a buffer is 90% full and then interrupting the Clear to Send (CTS) signal to stop the flow of data. When the buffer drops back to 50% full, the Business Modem sends CTS to restart the flow of data.

### Software Flow Control

Business Modems implement software flow control by detecting that a buffer is 90% full and then sending special characters in the data stream to stop the flow of data. When the buffer drops back to 50% full, the Business Modem sends special characters in the data stream to restart the flow of data.

The problem with software flow control is that the characters used to stop (<Ctrl>Q) and start (<Ctrl>S) the flow of data can occur naturally in the data flow. Enabling software flow control instructs the Business Modem to recognize and act on these characters, even if they are not intended to control the data flow.

Using software flow control may prove satisfactory if you're transferring text files only.

The start command is called XON (for transmit on) and the stop command is called XOFF (transmit off). You can change the characters used. See Registers S22 and S23 in Appendix B, Alphabetic Command Summary.

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## Received Data Flow Control

Flow control settings are controlled by the AT&Rn and AT&In commands. The default settings are &R2&I0. Use the following table for more information about setting the flow control.

| For your modem to | Command |
|---|---|
| Pause before sending CTS signal after receiving the Request to Send (RTS). | **AT&R0** |
| Ignore the RTS signal.<br>&R1 is required if your computer or software does not support RTS | **AT&R1** |
| Enable hardware flow control.<br>The Business Modem sends data to your computer only upon receipt of the RTS signal. | **AT&R2** |
| Disable software (XON/XOFF) flow control.<br>Recommended for non-ARQ (Normal mode) calls (see AT&I5). While the Business Modem is online, the only characters it recognizes are +++, the escape code. | **AT&I0** (Default) |
| Enable software (XON/XOFF) flow control. Use in ARQ mode only.<br>Keep in mind that the XON/XOFF characters sent to the remote computer may interfere with XON/XOFF signaling between the remote computer and remote device (see AT&I2). | **AT&I1** |
| Force the Business Modem to act on your XON/XOFF commands, but remove them from the data stream instead of passing them to the remote computer.<br>This ensures that the remote computer does not confuse your XON/XOFF characters with those from its attached device. This is the recommended setting for ARQ mode. | **AT&I2** |
| *When using the AT&I2 command, if the call is not in ARQ mode, there is no flow control on the link. If you send an XOFF to your modem and it stops passing data, it has no way to tell the remote computer and modem to stop sending for a while, and the local's buffer may overflow. For more reliable control in non ARQ mode, see AT&I5.* | |
| Enable Hewlett Packard-Host mode. Applies only to devices attached to an HP mainframe that uses the ENQ/ACK protocol. Use in ARQ mode only.<br>If you want to use software flow control to transfer non-text (binary) files, set serial port and connection rates equal using &B0 and & N0. See Chapter 9, *Controlling Data Rates* for more information about these commands. | **AT&I3** |

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| For your modem to | Command |
|---|---|
| Enable Hewlett Packard-Terminal mode. Applies only to Business Modems attached to terminals in an HP system that uses the ENQ/ACK protocol. Use in ARQ mode only. | **AT&I4** |
| Enable flow control when the connection is not under error control. For this to work, the remote device must also have AT&I5 capability. In ARQ mode, a Business Modem set to AT&I5 operates the same as it does when set to &I2. It acts on your XON/XOFF commands, but does not pass them to the remote system. The error-control protocol enables the devices to control the flow of data on the phone link.<br>In non-ARQ mode, a Business Modem set to AT&I5 operates as though flow control were disabled (AT&I0); it does not look for your typed XON/XOFF commands. However, it does look for XON/XOFF characters coming in over the phone link. When the remote device sends XON/XOFF commands, the Business Modem either resumes or stops transmitting data over the link and drops the characters from the data stream. | |
| If both devices are set to AT&I5, operators at each end can signal the remote device to stop sending. Thus, controlling the data flow on the phone link and preventing their own device's buffer from overflowing. At the computer/device interfaces, the devices independently control the flow of data through their Transmit Data (AT&H) settings. | **AT&I5** |

**Example:** Sending **AT&I2** will remove XON/XOFF commands from the data stream instead of sending them to the remote computer. This will force the Business Modem to act of the XON/XOFF commands.

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## Transmit-Data Flow Control

This type of flow control is for data transmitted to the Business Modem by its attached computer.

| For your modem to | Command |
|---|---|
| Disable transmit data flow control | **AT&H0** |
| Enable Hardware flow control.<br>Requires that your computer and software support Clear to Send (CTS) at the EIA-232 interface. | **AT&H1** |
| Enable Software flow control.<br>Requires that your software support XON/XOFF signaling. | **AT&H2** |
| Use both hardware and software flow control.<br>If you are unsure about what your equipment supports, select this option. | **AT&H3** |

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# 12 HANDSHAKING, ERROR CONTROL, DATA COMPRESSION, AND THROUGHPUT

This chapter contains information about:

- Handshaking
- Selective Reject
- V.90 Capabilities
- Error Control
- Data compression
- Getting maximum throughput

## Handshaking

With each call, Business Modems go through a link negotiation process with the remote device. Another name for the negotiation process is "handshaking."

Business Modems default to V.90 modulation and try for the highest possible speed when they attempt to connect with another modem: 56 Kbps. If the remote device is not V.34-capable, a connection is made using the highest compatible modulation scheme (x2, V.34, V.FC, V.32 terbo, V.32 bis, and so on, down to as low as Bell 103, or 300 bps).

### Selective Reject

The Business Modem supports Selective Reject for analog calls. Selective Reject improves performance on noisy lines by reducing the amount of overhead incurred when the protocol must resend data due to errors.

When Selective Reject is active, only the frame that contained the error is resent, instead of the frame plus all of the following unacknowledged frames.

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Selective Reject is an optional part of the ITU-T V.42 (LAPM) standard.

| For your modem to | Command |
|---|---|
| Enable Selective Reject | **ATS51.6=0** (Default) |
| Disable Selective Reject | **ATS51.6=1** |

### Attaining Speeds Above 28.8 Kbps

V.34 connections at 21.6, 24, and 26.4 Kbps are common. To get connections of 28.8, 31.2, and 33.6 Kbps, line quality must be pristine end-to-end. In addition, 31.2 and 33.6 Kbps connection rates are possible only when the device to which you are connecting also runs software that supports speeds above 28.8 Kbps.

### Attaining 56 K Connections

When a client x2 modem connects to a server x2 modem, the path through the telephone network between the modems is subject to the following conditions for an x2 connection to be made.

***A digital connection at one end.*** ISPs or other online services must have a digital connection to the public switched telephone network (PSTN). Most major online services have a digital connection to the PSTN.

***Only one digital-to-analog conversion.*** There can be only one digital-to-analog conversion in the telephone network between the x2 server modem and the x2 client modem.

### Controlling the V.8 Call Indicate Tone

The V.8 protocol speeds call negotiation and specifies a call indicate tone. Providing the call indicate tone is optional. For compatibility, we ship the Business Modem with the call indicate tone disabled.

| For your modem to | Command |
|---|---|
| Enable the call indicate tone | **ATS54.6=0** |

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If you enable the V.8 call indicate tone, expect to hear a sound like a fast ringing signal while the call is being connected.

**V.34** If the remote device has V.34 capability, Business Modem use a line probing technique to determine the highest speed possible under current line conditions, then they complete the connection. If the remote device does not have V.34 capability, the Business Modem listens to the device's answer tones to identify the standard rate at which the remote device is operating, and then adjusts to that rate.

When the Business Modem answers a call, it sends out a series of answer tone signals until both devices negotiate the best connection rate.

## V.90 Capabilities

The Business Modem has V.90 capabilities. The Business Modem can dial into V.90 servers to establish speeds up to 56K downstream.

| For your modem to | Command |
|---|---|
| Enable V.90 | **ATS58.5=0** (Default) |
| Disable V.90 | **ATS58.5=1** |

## Other Protocols

**x2** x2 client modems can receive data at speeds up to 56 kbps and send data at V.34 speeds. To use x2, the client x2 modem must connect to a server x2 modem. If clients attempt to connect to ISPs that do not use x2, the client modem will negotiate the next available modulation. For example, an x2 client modem calling into an ISP that only supports V.34, the modem will only negotiate the highest v.34 connection rate. The maximum V.34 connection speed is 33.6 kbps.

**Fast Class (V.FC) Handshaking** After trying V.34, the Business Modem tries for the fastest possible V.Fast Class (28.8 Kbps) connection. In order to negotiate V.FC, V.8 has to be disabled. V.FC is not part of the ITUV.8 training sequence.

If the remote device is not V.FC capable, a connection is made using the highest compatible modulation scheme (V.32 *terbo*, V.32 *bis*, and so on, down to as low as Bell 103, or 300 bps).

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If the remote device has V.FC capability, the Business Modem uses a line probing technique to determine the highest speed possible under current line conditions, then completes the connection. If the remote analog device does not have V.FC capability, the Business Modem listens to the device's answer tones to identify what standard rate the remote analog device is operating at, and adjusts to that rate.

When a Business Modem answers a call, it sends out a series of answer tone signals until both devices negotiate the best connection rate.

**HST**

We recommend that Business Modems retain the default B0 and &N0 settings. This allows them to make analog connections with "V." protocol and HST modems in both Originate and Answer modes at a variety of speeds.

When originating an analog call, the Business Modem set to B1 sends out a Bell answer tone, which is the prevalent standard in the U.S. and Canada for connections at 2400 bps and lower. At higher speeds, the Business Modem also recognizes the ITU answer tones necessary for connecting with V. protocol modems, and adjusts to the answering device.

However, when answering a call, a Business Modem sending out the Bell answer tone (B1) won't be recognized by V. protocol modems. The calling modem, instead, will wait until it detects a tone it recognizes. The V.22bis tone used at 2400 bps.

If you want to have your Business Modem connect with V. protocol modems at high speeds, make sure it is set to B0 for the ITU answer tones. It will also connect with HST modems at speeds up to 16.8 Kbps.

**USR V.32terbo to USR V.32terbo**

On these analog connections, Business Modems have two features that result in outstanding performance: Quick Connect and Adaptive Speed Leveling (ASL).

- Quick Connect allows two Business Modems to connect in approximately 7 seconds, a far shorter time than with most devices.
- ASL (described below in Other V.Protocol Operations) is used by Business Modems operating in V.32terbo and V.32bis modes.

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### Lower-speed V. Protocols

Older, lower-speed "V." protocols do not employ line probing. Instead they use predefined answer tones to specify or identify speed capabilities. These protocols define the following maximum speeds:

- **V.32terbo:** 19.2 Kbps, with an additional USR device-to-USR device speed of 21.6 Kbps.
- **V.32bis:** 14.4 Kbps.
- **V.32, V.22bis, etc.:** 9600 bps and lower.

ASL (used in V.32terbo and V.32bis modes) is a technique that allows the Business Modem's receivers and transmitters to act independently of each other. One transceiver may slow down and then speed up without affecting the data flow on the other. The result is more efficient line operation.

*While most modems on the market now use higher speeds, there may be a problem in answering older, V.32 modems at 9600 bps. Use Register S28 to modify the duration of the extra tones used in V.32 negotiations, in the rare instance that this may be necessary. See Appendix A, S-Registers.*

## Error Control

Business Modems can employ error-control techniques during data connections.

*High-speed data calls are vulnerable to errors unless the data is protected by error control. If your Business Modem connects with a remote device at a high speed, but without error control, and if you are not using an error control protocol for your call, you may lose data.*

Automatic Repeat Request (ARQ) is a method used in many error-control protocols to ensure that any data that has been corrupted in transit is retransmitted. We use the term to designate a connection under error control.

### Error-Control Commands

You can use Error-Control commands to enable ARQ (error control). The Business Modem and the remote device ***must*** use the same protocol.

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| For your modem to | Command |
|---|---|
| Have no error control (Normal Mode)<br>Due to the nature of phone line channels, this is never recommended for analog calls above 2400 bps | **AT&M0** |
| Operate in Normal mode if an ARQ connection can't be made (Normal/ARQ mode) | **AT&M4** |
| Hangs up if it can't make an ARQ connection (ARQ Asynchronous Mode) | **AT&M5** |

**Example:** Sending **AT&M4** allows your modem to operate in Normal Mode is an ARQ connection can't be made.

Error control is available for calls at 1200 bps and above. It can be disabled, although high-speed calls (9600 bps or higher) should always be under error control. The operations defined in an error-control protocol include:

- Establishing compatibility.
- Formatting data frames.
- Detecting errors using Cyclic Redundancy Checking (CRC).
- Retransmitting corrupt data frames.

The Business Modem is set at the factory to try for an error-control connection and, if that isn't possible, to proceed with the call in Normal mode. This means that &M4 is set.

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### V.42 Error Control

The Business Modem first tries for a V.42 connection, then an MNP connection. The following information is based on the Business Modem's setting of &M4.

This international standard includes a two-stage hand-shaking process:

- A **Detection** phase that is based on an exchange of predefined characters.
- A **Link Access Procedures for Modems (LAPM) Negotiation** phase, during which the devices identify their capabilities concerning maximum data block size and the number of outstanding data blocks allowed before an acknowledgment is required.

### MNP Error Control

The Microcom Networking Protocol (MNP) is supported by the ITU-T V.42 Recommendation. MNP is based on special protocol frames. If the remote device doesn't recognize an MNP Link Request, error control isn't possible. (In HST asymmetrical mode, 3Com devices use a proprietary scheme similar to MNP.)

### Error Control and Flow Control

Flow control of data from the computer is required under error control for two reasons:

- The transmitting device buffers a copy of each frame it transmits to the remote end until it is acknowledged by the receiving device.
- If errors are encountered, retransmission activity can cause a steady stream of data from the computer to overflow the buffer.

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## Data Compression

Business Modems employ different data compression techniques during data connections.

| For the modem to | Command |
|---|---|
| Disable data compression | **AT&K0** |
| Auto-enable/disable data compression. The Business Modem enables compression if the serial port rate is fixed (&B1) and disables compression if the serial port rate follows the connection rate (&B0). | **AT&K1** (Default) |
| Always enable data compression | **AT&K2** |
| Selective data compression. Use this setting to transfer compressed files. The Business Modem negotiates only for V.42bis compression, and disables MNP Level 5 (MNP5) compression. | **AT&K3** |

**Example:** Sending **AT&K3** is used to transfer compressed files. The modem will only negotiate for V.42bis compression. This command also will disable MNP Level 5 (MNP5) compression.

If a Business Modem successfully establishes a V.42 error control connection with a remote device, it also negotiates for V.42 *bis* data compression.

If a Business Modem successfully establishes an MNP connection with a remote device, it also negotiates for MNP5 data compression.

The type of compression for a call, if any, is reported in the ATI6 display and in the CONNECT message if the modem is set to &A3.

### V.42bis versus MNP5 Data Compression

Business Modems using V.42bis compression negotiate the following options and report them in the ATI6 display:

- Dictionary size, that is, the amount of memory available for compression table entries. (Entries are codes devised for redundant data. The data is packed into shorter data units, called code words, and unpacked by the receiving device.)

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Possible dictionary sizes:

| Bits | Entries |
|---|---|
| 9 | 512 |
| 10 | 1024 |
| 11 | 2048 |

Your modem uses an 11-bit, or 2048-entry dictionary, but they can reduce its size to accommodate a remote modem that uses a 9- or 10-bit dictionary.

- Maximum string length of each entry. As the dictionary fills, your modem deletes the oldest unused strings.

V.42*bis* compression is more efficient than MNP5 compression, in part because it dynamically deletes entries that are no longer used. In addition, it works better with files that are already compressed. These include.ZIP files and 8-bit binary files.

MNP5 compression should NOT be used with binary files because it adds data to the files, which lessens throughput. (The additional data is stripped when the file is decompressed by the remote modem.) When transferring such files, it's best to set the modem to &K3 (See the information in data compression). This allows V.42bis compression to work dynamically with the compressed data, but disables MNP5.

## Getting Maximum Throughput

The following guidelines should help you to make the most of the Business Modem's advanced performance features. In many instances, experimentation and experience will indicate what works best for your applications.

**Maximum throughput results when:**

- The communications software allows fixing the serial port rate higher than the connection rate, by setting the software to 115200, 57600, or 38400 bps and setting the Business Modem to &B1.

  If the software automatically switches serial port rates to follow the connection rate, the Business Modem's serial port rate must be also set to follow the connection rate for each call, &B0, and throughput will be limited.

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Installations with specialized software may want to enable a fixed serial port rate for ARQ calls and a variable serial port rate for non-ARQ calls. See the &B2 command in Appendix B, Alphabetic Command Summary.

- The call is under data compression.
- The data is made up of text files rather than binary files such as .EXE or .ZIP files.
- MNP5 compression is disabled for files that are already compressed, and 8-bit binary files that appear to modems to be already compressed. Disable MNP5 compressing by sending the Business Modem AT&K3.
- The file transfer is not slowed down by a file-transfer protocol. Many non-text files require a file transfer protocol, but the results vary.

*For the best throughput, on error-controlled connections only and with hardware flow control, we recommend the most current version of ZMODEM file transfer protocol.*

For example, certain public domain file transfer protocols have the following effects:

| Public Domain | Effects |
|---|---|
| Kermit | Newer versions support packets up to 9K and a sliding window design to eliminate turnaround delay. With earlier versions, however, throughput may be severely reduced due to short block lengths (possibly under 128 bytes) and acknowledgment turnaround time. |
| XMODEM | Throughput may be reduced if your version uses short block lengths (128 bytes). Some versions use larger blocks (1K blocks). Throughput is also reduced by overhead (error control protocol information). |
| YMODEM | There is an improvement over XMODEM, due to larger block lengths (1K bytes), but throughput is still reduced by the protocol's error control overhead. |

The protocols listed above further reduce throughput when an error control connection is established. The accuracy of the data is checked both by the file transfer protocol and the Business Modem. To avoid redundancy, use the above protocols only for non-ARQ connections, and only at speeds of 2400 bps and below.

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Overhead is minimal with ZMODEM, resulting in throughput that is almost equal to that obtained with no file-transfer protocol. ZMODEM should also be used for non-ARQ connections. Leave the Business Modem at its &M4 and &K1 settings for both error control and data compression.

YMODEM-G is another good choice, but never use it unless both the local and remote devices are using error control: if YMODEM-G detects an error, it aborts the transfer. Do not use either protocol with software flow control (XON/XOFF signaling).

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# 13 DISPLAYING QUERYING AND HELP SCREENS

This chapter contains information about:

- Querying
- Displaying help

*To view screen captures of the help screens in the following chapter, see Appendix B, Alphabetic Command Summary.*

## Overview

The Business Modem can display information such as the current settings, product code, and call duration.

**Common Inquiry Commands**

| For your modem to display | Command |
|---|---|
| Current settings | **ATI4** |
| NVRAM settings | **ATI5** |
| Link diagnostics summary | **ATI6** |

## Querying

Here is a complete list of ATI*n* commands.

| For your modem to | Command |
|---|---|
| Display a four-digit product code. | **ATI0** |
| Perform a checksum of the modem's read-only memory (ROM) and display the results. (This function is used only in factory testing.)<br>The Business Modem should always display the same number. | **ATI1** |

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| For your modem to | Command |
|---|---|
| Perform a test of the modem's random-access memory (RAM) and display either OK (0) or ERROR (4), followed by OK when the test is completed. You may want to use this command if the Business Modem appears to be malfunctioning. | **ATI2** |
| Display the Business Modem's banner, or product title. | **ATI3** |
| Display the Business Modem's current configuration. | **ATI4** |
| Display the configuration saved in nonvolatile random access memory (NVRAM). If your Business Modem connects to a device that has Dial Security and local access enabled, you cannot view the stored phone numbers. | **ATI5** |
| Display a diagnostic summary. During a connection, the Business Modem monitors and stores information about link operations. When the call is ended, you can request a diagnostic summary.<br>The duration of the last call or the real time is displayed, depending on the modem clock setting.<br>For calls under data compression, the number of characters sent may be less than the number of octets sent, due to data compression operations. | **ATI6** |
| Display the product configuration. | **ATI7** |
| Display the Dial Security Account Status. For security administrators only, unless local security is disabled (S53=0 or S53.2=0) | **ATI10** |
| Display a connection report that 3Com Technical Support representatives use to help you solve problems. | **ATI11** |
| Display caller ID information from the current call (if in progress) or the last call (if between calls).<br>The caller ID information remains until either the modem is reset or until the modem receives another valid caller ID signal. | **ATI15** |

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## Displaying Help

The Business Modem provides six help, or command summary, screens: basic AT command set, ampersand (&) command set, percent (%) command set, percent (%) command set, dial command options (D), S-Registers (S), and the octothorpe (#) command set.

| For your modem to display | Command |
|---|---|
| A partial summary of the basic command set | **AT$** |
| A partial summary of the ampersand command set | **AT&$** |
| A partial summary of S-Register functions | **ATS$** |
| A partial summary of percent command set | **AT%$** |
| A summary of the octothorpe command set | **AT#$** |

*To see the remainder of the screen for any given command, press any key.*

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# 14 TESTING THE CONNECTION

This chapter contains information about:

- Testing the Business Modem using AT&T*n*
- Testing the Business Modem using S-Register 16

## Overview

Your modem can perform digital and remote digital loopback tests. You can use these tests to check the operations of the transmitter and receiver, or to locate a problem with a remote device or a telephone line.

Testing is done by sending the AT&T*n* command or by setting Register S16. Only one test can be performed at a given time. If you send a test command while the modem is in test mode, you'll receive an ERROR message.

All loopback testing conforms to ITU-T Recommendation V.54.

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## Testing the Business Modem using AT&T*n*

To perform digital loopback and remote digital loopback testing use the AT&T*n* command. You can type in your own data during testing or use the modem's internal test pattern and error detector. See the following sections for more detailed information about each AT&T*n* command.

| For your modem to | Command |
|---|---|
| End testing | **AT&T0** |
| Enter analog loopback (AL) mode and send a CONNECT message. Data is shown on your screen. | **AT&T1** |
| Enter analog loopback mode and send a CONNECT message. The Business Modem sends a internal test pattern to the transmitter and loops the pattern back to the receiver. No data is seen on your screen. | **AT&T2** |
| Start local digital loopback testing | **AT&T3** |
| Grant a remote digital loopback test of your Business Modem | **AT&T4** |
| Deny a remote digital loopback test of your Business Modem | **AT&T5** |
| Start local digital loopback testing | **AT&T6** |
| Start remote digital loopback with self-test and error detection | **AT&T7** |

**Example:** Sending **AT&T5** will deny any requests from remote devices for a remote digital loopback test of your Business Modem.

*Disable error control (using the &M0 command, see Appendix B,* Alphabetic Command Summary*) before testing. If the modem is detecting errors and retransmitting the affected data, your results will be invalid.*

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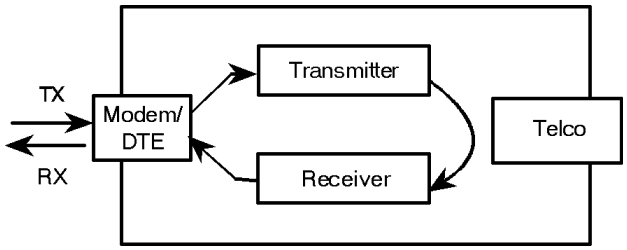
## Analog Loopback Testing

Local loopback testing checks the operation of the Business Modem transmitter and receiver.




### Using AT&T1

1. Send **AT&M0&N3S14.0=0** to prepare the modem for testing.

   This command disables error control, fixes the connection rate at 2400 bps, and makes the modem return to command mode when you type **+++**.

2. Send **AT&T1** to the modem so it enters analog loopback mode. The MR status light flashes.
3. It will be looped back by your modem's transmitter for verification on your screen.
4. When the test is completed, send **+++** and then **AT&T0** to end the test.

   Alternatively, you can end the test by sending **ATH**, or **ATZ.** Be careful, though, because ATZ resets the modem in addition to ending the test.

   In either case, the modem responds with OK. If the modem sends an ERROR message, you have issued an invalid command.

5. Send **AT&M4**, unless you used a reset command (ATZ).

*If the Business Modem is in online mode that is still connected to a remote modem, and you send AT&T1 or AT&T8, it drops the call, enters analog loopback mode, sends a CONNECT result and waits for loopback characters.*

## Stopping a Test (AT&T0, ATS18)

To stop a test, send **AT&T0** to the modem, or set Register S18 to a specified number of seconds (for example, **ATS18=10**). When the 10 seconds are up, the modem will stop the test automatically and return to Command Mode. Send **ATH** to the modem to hang up, or send **ATZ** to hang up and reset the modem to its defaults.

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*If you use the S18 test timer, but in the process of testing you issue an ATZ command, S18 resets to zero and the timer is disabled. You cannot store a value for S18 in NVRAM; its power-on and reset default is always zero.*

### Using AT&T8

This analog loopback option causes the Business Modem to send an internal test pattern to its transmitter and loop it back to the receiver. An internal error detector counts any errors and, when the test is ended, sends the number of errors or 000 (no errors) to the screen.

Since you don't type anything during this test, and the Business Modem does not send anything to the screen, this option verifies only the Business Modem. If there are no errors but your problem continues, it may be at the computer interface.

1 Send **AT&M0&N3S14.0=0** to the modem prepare for testing.

This command disables error control, fixes the connection rate at 2400 bps, and makes the Business Modem return to command mode when you type **+++**.

2 Send **AT&T8** to begin the test.

The Business Modem enters analog loopback (AL) mode, and sends a CONNECT message. The MR status light flashes. The V.Everyhing then sends its internal test pattern to the transmitter, and loops the pattern back to the receiver. You will not see any data on your screen.

3 Send the escape code, **+++**, and then **AT&T0** to end the test.

Alternatively, you can end the test by sending ATH or ATZ. Be careful, because ATZ resets the modem in addition to ending the test.

In any case, the Business Modem hangs up and returns a three-digit code, followed by OK.

| The code | Indicates |
|---|---|
| 000 | No errors were found |
| 255 | 255 or more errors |
| An ERROR message indicates that you issued an invalid command. | |

4 Send **AT&M4**, unless you used a reset command (ATZ or ATZ!).

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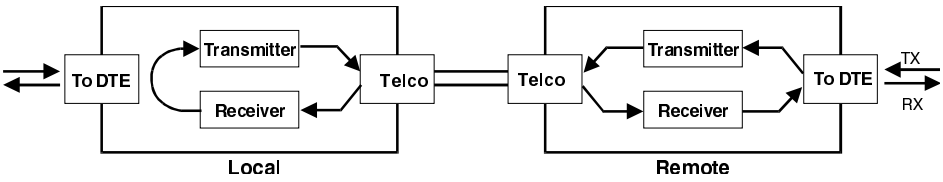
**Digital Loopback Testing (AT&T3)**

This test can help you locate a problem with a remote device or with the telephone line. The figure below shows the data flow during Digital Loopback (DL) testing.




1. Send the command **AT&M0&N3S14.0=0** to the modem to prepare for testing.

   This command disables error control, fixes the connection rate at 2400 bps, and makes the Business Modem return to command mode when you type +++.

2. Establish a connection with the remote device.
3. Send the Business Modem the escape code, **+++**, to bring it back to Command mode.
4. Send **AT&T3** to the modem to enter Digital Loopback mode.
5. Have the remote user type a short message. It will be looped back by your Business Modem's transmitter for verification on the remote user's screen. You will not see the message or any other data.
6. When the remote user has completed the test, send the escape code, **+++**, and then **AT&T0** to end the test.

   Alternatively, you can end the test by sending ATH or ATZ. Be careful, because ATZ resets the modem in addition to ending the test.

   In any case, the Business Modem responds OK. If the modem sends an ERROR message, you have issued an invalid command.

7. Send **AT&M4**, unless you used ATZ.

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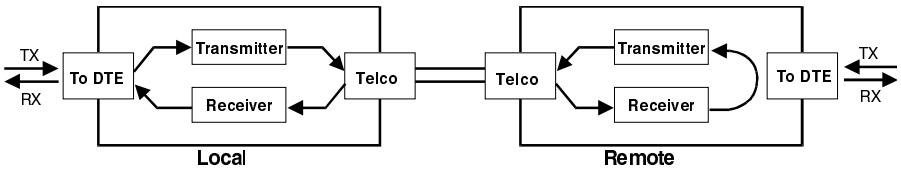
### Remote Digital Loopback Testing (AT&T6, AT&T7)

The remote digital loopback test, verifies the condition of both devices and of the phone line. Data flow is shown in the figure below.




**Data Flow During Remote Digital Loopback.**

The request for and granting of remote digital loopback testing requires that both devices use ITU-T V.22 standard signaling. If the remote device does not have the capability or is not set to respond (with **AT&T4**), you will get an ERROR result code.

There are two remote digital loopback options.

| If you want to | Command |
|---|---|
| Send keyboard data to the modem and verify it when it is returned over the phone lines and to your screen | **AT&T6** |
| Have the modem send its internal test pattern and return an error count to your screen | **AT&T7** |

**Example:** Sending **AT&T6** will verify keyboard data sent to the modem by returning it over the phone lines and displaying it on your screen.

### Granting a Digital Loopback Test Request (AT&T4)

Using **AT&T4** causes the Business Modem to grant a remote device's request for a remote digital loop-back test.

### Canceling All Digital Loopback Test Requests (&T5)

Using **AT&T5** cancels **AT&T4**, and the Business Modem fails to acknowledge remote digital loopback test requests. This is the default so that your Business Modem isn't subject to another user calling and tying up your Business Modem without your permission.

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### Testing Using Keyboard Data (AT&T6)

1. Send **AT&M0&N3S14.0=0** to prepare the Business Modem for testing.

   This command disables error control, fixes the connection rate at 2400 bps, and makes the Business Modem return to command mode when you type the escape code (**+++**).

2. Establish a connection with the remote device.

3. If you haven't already done so, arrange with the remote user to cooperate with the test.

   If necessary, set the remote device to acknowledge the remote digital loopback request. For example, older modems need to be set to S16=8.

4. Send **AT&T6** to the modem. The modem enters remote digital loopback mode, and the MR status light flashes.

5. Type a short message. It will be looped back to your modem by the remote device and to your screen for verification. (The remote user will not see your data.)

6. Send the escape code, **+++**, and then **AT&T0** to end the test.

   Alternatively, you can end the test by sending **ATH**, **ATZ**, or **ATZ!** Be careful, because ATZ and ATZ! reset the Business Modem in addition to ending the test.

   If you issue an invalid command, the Business Modem sends an ERROR message. If you set Register S18, the Business Modem automatically ends the test when the test timeout is reached. See the example in the previous section, *Stopping a Test* for an example of using S18.

   Data errors indicate a problem with the remote device or with the phone link.

7. Send **AT&M4**, unless you used a reset command (ATZ or ATZ!).

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### Testing Using a Built-in Test Pattern (AT&T7)

This test option causes the modem to perform a remote digital loopback test by sending a built-in test pattern. An internal error detector counts any errors and, when the test is ended, sends the number of errors or 000 (no errors) to the screen.

Follow the steps below. However, you don't need to type anything during this test. The modem sends only its final error count to your screen.

1. Send **AT&M0&N3S14.0=0** to prepare the Business Modem for testing.

   This command disables error control, fixes the connection rate at 2400 bps, and makes the Business Modem return to command mode when you type the escape code (**+++**).

2. Establish a connection with the remote device.

3. If you haven't already done so, arrange with the remote user to cooperate with the test.

   If necessary, set the remote device to acknowledge the remote digital loopback request. For example, older 3Com modems need to be set to S16=8.

4. Send **AT&T7** to the modem. The modem enters remote digital loopback mode, and the MR status light flashes.

   The Business Modem sends its built-in test pattern to the remote device, which loops it back to your Business Modem. You will not see the data on your screen.

5. Send the escape code, **+++**, and then **AT&T0** to end the test. You can also end the test by sending **ATH**, **ATZ**, or **ATZ!** Be careful, though, because ATZ and ATZ! reset the Business Modem in addition to ending the test.

   If you issue an invalid command, the Business Modem sends an ERROR message. If you set Register S18, the Business Modem automatically ends the test when the test timeout is reached. See the example in the previous section, *Stopping a Test* for an example of using S18.

   When the test ends, the Business Modem returns a three-digit code, followed by OK. A code of 000 indicates no errors were found; a code of 255 indicates 255 or more errors.

   Data errors indicate a problem with the remote device or with the phone link.

6. Send **AT&M4**, unless you used a reset command (ATZ or ATZ!).

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## Testing the Business Modem using S-Resister 16

Register S16 is a bit-mapped register (See Appendix A, *S-Registers*, for instructions for setting bit-mapped registers).

| For your modem to use | Use one of these command |
|---|---|
| Remote digital loopback with built-in test pattern | **ATS16=4** or **ATS16.2=1** |
| Remote digital loopback using keyboard data | **ATS16=8** or **ATS16.3=1** |

*Earlier modems require bit 3 to be enabled to grant digital loopback testing to a remote device. The Business Modem requires the &T4 setting instead. To perform remote digital loopback testing with a modem that does not use the &T test command, that modem should be set to S16=8.*

### Analog Loopback (AL) S16=1D

To use the modem's Test Pattern (S16, bit 2) instead of typing your own data, see RDL Testing Using a Built-in Test Pattern (S16=4).

1. Send **AT&M0&N3S14.0=0** to the modem to prepare for testing.

   This command disables error control, fixes the connection rate at 2400 bps, and makes the Business Modem return to command mode when you type **+++**.

2. Send **ATS16=1D**. The modem enters AL mode and sends a CONNECT result code. The MR status light flashes.

3. Type data to the modem for it to transmit, loop to its receiver, and output to the screen.

   An alternative is to use the Test Pattern, described later.

4. Send the escape code, **+++**, and then **ATH** to end the test.

5. Send **AT&M4**, unless you used a reset command (ATZ or ATZ!).

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### Testing Using Keyboard Data (ATS16=8)

1. Send **AT&M0&N3S14.0=0** to prepare the Business Modem for testing.

   This command disables error control, fixes the connection rate at 2400 bps, and makes the Business Modem return to command mode when you type the escape code (**+++**).

2. Establish a connection with the remote device.

3. If you haven't already done so, arrange with the remote user to cooperate with the test.

   If necessary, set the remote device to acknowledge the remote digital loopback request. 3Com modems should be set to &T4. (Older 3Com modems should be set to S16=8.)

4. Send the Business Modem **ATS16=8O**.

   The Business Modem enters remote digital loopback mode and then goes back online (O command). It then transmits the test signals, causing the remote device to enter remote digital loopback mode. The MR status light flashes during this operation.

5. Type a short message. It will be looped back to your Business Modem by the remote device and to your screen for verification. (The remote user will not see your data.)

6. Send the escape code, **+++**, and then **ATS16=0** to end the test.

   If you issue an invalid command, the Business Modem sends an ERROR message. If you set Register S18, the Business Modem automatically ends the test when the test timeout is reached. See the example in the previous section, *Stopping a Test* for an example of using S18.

   If you wish to resume data transmission with the remote device, add the O command (ATO) after the **ATS16=0** string to return online. If you do this, remember that error control is disabled. Because error control is negotiated during the connection sequence, its status cannot be changed until the Business Modem is back on hook and in Command mode.

7. Send **AT&M4**, unless you used a reset command (ATZ or ATZ!**)**.

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## Testing Using a Built-in Test Pattern (ATS16=4)

The test pattern is available at all speeds. At 300 bps, the Business Modem's serial port rate must be fixed (&B1) and the link rate fixed at 300 bps (&N1). At rates over 9600 bps, just set the Business Modem for a fixed serial port rate (&B1).

### Starting Testing That Uses the Test Pattern

| To use the test pattern during testing with | Command |
|---|---|
| S-Register 16 | **AT&M0S16=12**. |
| The &T test<br><br>The test pattern is used for testing equipment and the phone line. When S16 is set to 4, the Business Modem transmits the test pattern when it connects with a remote device. | 1. Send **ATS16=4** (test pattern command)<br><br>2. Send **ATS16=4&T6**. |

## Ending Testing That Uses the Test Pattern

Pressing any character key cancels all tests and hangs up the Business Modem. If you used Register S16, be sure to reset Register S16 and return to the error-control default. Send **ATZ** or **AT&M4S16=0** to the modem.

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# 15 TROUBLESHOOTING

This chapter explains how to troubleshoot the Business Modem. This chapter is divided into these sections:

- Problems that occur before connecting.
- Problems that occur after connecting.
- What to do if you still have problems.

## Problems That Occur Before Connecting

**No response to AT**

For Windows users, make sure that you set the correct COM port and IRQ in your communications software and, if applicable, in Windows' Control Panel - Ports.

For Macintosh users, make sure that you set the correct serial port (modem port or printer port) and that AppleTalk is disabled.

- Make sure that your communications software is in Terminal mode.
- Be sure that your communications software is set to the correct bit rate and word length (7 bits with or without a parity bit, or 8 bits and no parity).

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- Make sure that verbal result codes (status messages) are enabled. Send these commands to the Business Modem:

| For your modem to | Command |
|---|---|
| enable message display | **ATQ0** |
| Display verbal messages | **ATV1** |

- Review your communications software manual to see what Carrier Detect (CD) operations your software requires. Then see the chapter about Controlling EIA-232 Signaling.
- Although it is a rare condition, check whether your computer is reversing the send/receive functions at the EIA-232 interface. Refer to your computer's documentation.
- Check your RS 232 cable to make sure it is not a NULL modem cable.

### The Business Modem won't dial

- You may need to change the DTR setting at the Business Modem. If so, see the chapter about Controlling EIA-232 Signaling.
- Make sure that the phone line from your wall jack connects to JACK port of the Business Modem.
- Make sure the Business Modem is connected to a standard analog phone line and not to a digital system (typically found in offices and hotels).
- If the Business Modem responds NO DIAL TONE when you attempt to dial, first make sure that the phone line is connected to the JACK port on the back of the Business Modem.

  If you hear dial tone when the Business Modem tries to dial but, it quickly returns off hook and reports NO DIAL TONE, try adding X5 to the dial string, for example sending ATDTX5 5551212. The Business Modem will ignore dial tone detection.

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**Double characters are appearing on your monitor**

This is a signal that both the Business Modem's local echo and your software's local echo are on.

Type the command to turn off your online echo (ATF1) or turn your communications software's local echo off (refer to your software's documentation).

**After you dial, the Business Modem reports NO CARRIER and then hangs up**

- Try increasing S7 and decreasing S9 to allow more time for the connection.
- Try calling a different device. If you are trying to connect to an older modem at 2400 bps or less, it may not support error control. Try sending AT&M0, and then try the call again. Reset the Business Modem (send ATZ) after you finish the call.

**Hear ringing but the Business Modem won't answer**

- Look at the TR LED to make sure that your terminal or computer is sending a DTR signal via the EIA-232 interface.
- Send ATI4 to the Business Modem and check that S0 is set to a value higher than 0.
- Set &F1 and S0=1, then try again.

**The Business Modem acts as though a data link has been established, but no call was received,**

Carrier Detect (CD) may be overridden (with &C0), but your system may require that the override be turned OFF (with &C1). Review your communications software manual to see what CD operations are required.

**The Business Modem behaves as if <Enter> were pressed when you don't press any keys**

Your software may be misreading signals from the Business Modem when the Business Modem sends a Carriage Return and a Line Feed before and after the RING and CONNECT messages. Sending the Quiet mode command, ATQ1, should solve the problem.

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## Problems that Occur After Connecting

### Your screen displays random or "garbage" characters

Make sure that the Business Modem is set to the same bit rate, word length, parity, and number of Stop bits as the device to which you are connecting.

If the settings are correct, the problem may be with the phone line. Try the following measures:

- Place the call again. The phone company routes even local calls differently each time you call.
- Call a different device to see if the problem persists. The problem may be with the device you first tried to call.

If the modem is set to a fixed serial port rate (&B1) and your software is fixed at 19.2K, 38.4K, 57.6K, or 115.2K bps, the reason may be one of the following:

- Your computer may not support the higher serial port rate. If this is the case, fix your software rate at 9600 bps.
- If you use memory-resident programs (TSRs-Terminate and Stay Resident programs) or disk-caching programs, they may be interfering. Try disabling them before you run your communications software.
- Check that your software and the Business Modem are set for the same kind of flow control, either hardware or software. Some communications programs also require that you disable the type you are not using.

### Many CRC errors

- Send AT&F1 to enable hardware flow control and other optimized settings.
- Try a different file transfer protocol (use ZMODEM if it's available to you)
- If you use memory-resident programs (TSRs-Terminate and Stay Resident programs) or disk-caching programs, they may be interfering. Try disabling them before you run your communications software.

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### Mainframe computer keeps dropping your connection

You must turn off the Business Modem's result codes and character echo (ATQ1E0). The modem at the mainframe also needs to be set to ATQ1E0.

### Bad faxes or can't fax

- Make sure the fax software is set to use Class 1 fax. Refer to your fax software's manual.
- If you use memory-resident programs (TSRs-Terminate and Stay Resident programs) or disk-caching programs, they may be interfering. Try disabling them before you run your communications software.

### Both devices exchange carrier signals, but fail to establish a communications link

- Make sure the Business Modem is in the correct mode, fax or data, depending on whether the connection is to be made with a facsimile device or a data device.

  See Chapter 2, Modes of Operation, for information on switching between Fax and Data modes.
- Make sure the proper bit rate, word length, parity and number of Stop bits have been selected.
- Send ATI4 and check to see that your modem is at the correct Bn setting to connect with either an HST modem (B1 setting) or "V." modem (B0 setting).
- Make sure that your Business Modem's connection rate setting, &Nn, is correct for the call. If the connection rate is locked at a speed (&N1-&N14) different from the calling modem's, the Business Modem hangs up. The default setting of &N0, variable link operations, allows the two modems to negotiate the highest possible connection rate.
- If your modem is attempting to answer a V.32 call, you may need to lengthen the extra V.32 answer tones. See Appendix B, Alphabetic Command Summary, under S28.

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- If you are attempting to make a connection using HST modulation, make sure that the modem at the other end of the line is HST compatible, V.32 terbo compatible at 14.4 Kbps, V.32 compatible at 9600 bps, V.22 bis-compatible at 2400 bps, Bell 212A-compatible at 1200 bps, or Bell 103-compatible at 300 bps.
- If none of the above corrects the problem, it's likely that the quality of the phone connection is poor. The variable quality of phone line connections may be due to any number of conditions in the phone service's equipment or the current environment. Try several calls, and if you still can't get through, try calling another device. If the second device accepts your call, the problem may lie with the device you first tried to call.

### Errors during software download

Try running the SDL program, or performing the XMODEM file transfer, at a slower serial port rate. If your computer doesn't have a 16550 UART, set your communications software to use a slower serial port.

You can also try running the program on a different PC. An idiosyncrasy of an off-brand PC or an uncommon version of DOS may lock up the SDL program.

### If You Still Have Problems

The problems described above are by far the most common ones that users encounter. If the suggestions we've given don't clear up your difficulties, try the following:

1. Review the *Getting Started Guide* carefully to see if you've missed something.
2. Call or visit your dealer. Chances are that your dealer will be able to give you the assistance you need. This is much more efficient (and time-saving) than returning the product to 3Com Corporation.
3. If your dealer can't help you, refer to the *Getting Started Guide* provided in this package. This guide lists several important 3Com numbers.
4. If you must return your Business Modem to us, the Service Representative you talk with will give you a Service Repair Order (SRO) number. Products without an SRO number will not be accepted.

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**5** If you do return the Business Modem to us, please follow these procedures:

**a** Ship the unit, postage pre-paid, in its original container. If the original container is not available, pack the unit carefully in a strong box of corrugated cardboard with plenty of packing material.

**b** Be sure to include your SRO number inside the package, along with your name and address. Put your return address and your SRO number on the shipping label as well.

**c** Ship the package to the following address:

**3Com Corporation**
**SRO# _____**
**attn: Dock 15 PCD**
**1800 West Central**
**Mount Prospect, IL 60056**

*3Com will not accept packages sent COD, so be sure to send the modem postage paid.*

3Com will repair your Business Modem and return it to you via United Parcel Service.

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# 16 UPGRADING YOUR MODEM

This chapter contains information about:

- Checking your modem's software version
- Getting new operating software
- Sending new software to the modem
- If your modem doesn't respond

## Overview

3Com periodically releases updates and enhancements to the modem's operating software which are made publicly available from our Web site, BBS, and ftp site.

## Checking Your Business Modem's Software Version

Issuing the **ATI7** command produces the following information.

```
ati7

3Com OfficeConnect 56K Business Modem Configuration
Profile...

Product type            US/Canada External
Options                 HST,V32bis,Terbo,V.FC,V34+
Fax Options             Class 1/Class 2.0
Clock Freq              20.16Mhz
Eprom                   256k
Ram                     32k

Supervisor date         04/02/96
DSP date                09/28/95

Supervisor rev          6.4.5
DSP rev                 1.3.0

OK
```

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Check the Supervisor and Digital Signal Processor (DSP) dates found in the last two lines of the screen display. These dates will determine which version of the software your modem is using.

The best way to find out the current shipping version of the modem's software is to visit the 3Com U.S. Robotics Web site at http://www.usr.com/home/online.

## Getting New Operating Software

To get the newest version of the Business Modem's operating software:

- Go to the 3Com U.S. Robotics Web site at http://www.usr.com/home/online. Select Upgrades/Updates. You will then have a choice of having the site help you determine your product code or entering the product code directly. Once you have product code, you can be sent to the latest firmware web page.
- Call the 3Com Bulletin Board Service (BBS) at (847) 262-6000.
  - From the main menu, select Files
  - Select area 5, USR Business Modem
  - Download the newest Business Modem file with the extension .ZIP

    Remember to select the proper ZIP file for your Business Modem.
- If you have problems with downloading the current shipping version of the modem's software call 3Com Technical Support at (888) 326-6099.

## Sending New Software to your modem

To send the new code to your modem, all you need is a standard terminal program that can send files using the XMODEM protocol.

1 Start a communications software package, such as Hyperterminal, Quick Link II or MacComCenter. Adjust the settings, if necessary, so you can send AT to your modem and get an OK response.

*If you are sending the file from a Macintosh computer, make sure you do not transfer the file in MacBinary format. In MacComCenter, for example, select Setup | File Transfer.... Under MacBinary options, select Never MacBinary.*

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**2** Enter **AT~X!**. The modem should respond as follows:

```
at~x!

SDL Xmodem file transfer - (Y)es (N)o (T)est >
```

**3** Type **t <ENTER>** to start an integrity test of the XMD file. Your screen should appear as follows:

```
SDL Xmodem file transfer - (Y)es (N)o (T)est >t
* Test Mode - Flash ROM will not be modified*
Begin Xmodem file transfer now.
CC
```

Send the file to your modem using the XMODEM-Checksum or XMODEM-CRC protocol. Since this is a test, the modem's existing software is not erased.

**4** After you've completed the test transfer successfully, use your communications software to send the XMD file using the XMODEM-Checksum or XMODEM-CRC protocol. See below:

```
at~x!

SDL Xmodem file transfer - (Y)es (N)o (T)est >y
Begin Xmodem file transfer now.
CC

SDL Xmodem file transfer completed.
Calculating CRC... OK
Resetting modem...OK
```

Once you see the OK response to the Calculating CRC and Resetting modem messages, your software upgrade is complete!

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## If Your Modem Doesn't Respond

If your modem doesn't respond after the flash process, its memory may be corrupted. Follow these steps to force the new software to the modem.

1. Power your modem off. The power switch is in the rear right corner of the back panel.
2. While holding in the RESET button (between the RS-232 and USB jacks), turn the modem back on.
3. Start your communications software package. Set your port speed to 57,600 bps, type **AT** and press <Enter>.

   If the Business Modem reports **Corrupt Firmware**, issue the **AT~X!** command and repeat the flash process found on the previous page.

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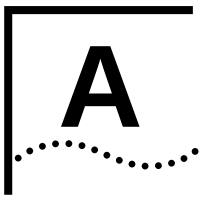

# S-REGISTERS

## Understanding Bit-Mapped S-Registers

A bit-mapped S-Register uses one number to describe a collection of settings. Bit-mapping allows us to pack a lot of information in a small space.

Bit-mapped registers are in the form of Sr.b=n, where r is the bit-mapped register;.b is the bit; n is 0 (off) or 1 (on).

The modem displays the value of an S-Register, as a decimal value between 0 and 255. The modem, however, understands the decimal value as a collection of binary digits (bits).

## How bits are mapped to decimal values

Bits can be mapped into decimal values. Each bit can be either on (1) or off (0). Eight bits create 256 unique combinations of 1s and 0s. Each of the eight bits can be assigned a number corresponding to its position:

b b b b b b b b

7 6 5 4 3 2 1 0

Also, each bit can be assigned a value corresponding to its number:

| Bit | | | Value |
|---|---|---|---|
| 7 | $2^7$ | = | 128 |
| 6 | $2^6$ | = | 64 |
| 5 | $2^5$ | = | 32 |
| 4 | $2^4$ | = | 16 |
| 3 | $2^3$ | = | 8 |
| 2 | $2^2$ | = | 4 |
| 1 | $2^1$ | = | 2 |
| 0 | $2^0$ | = | 1 |

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## Converting Bits to Decimal Values

Starting with a string of eight bits, assign each "1" bit a value based on its position. Add the values to come up with the final decimal value.

Here's an example of how bits are converted to decimal values:

01001111

| **0** | **1** | **0** | **0** | **1** | **1** | **1** | **1** | |
|---|---|---|---|---|---|---|---|---|
| 0 | + 64 | + 0 | + 0 | + 8 | + 4 | + 2 | + 1 | = 79 |

## Converting Decimal Values to Bits

Convert decimal values to bits by finding the largest decimal equivalent that is less than the decimal value. Subtract the decimal equivalent and mark the equivalent bit "1." Continue until the decimal value is zero. See the example below.

**113**

113 - 64 = 49

*01*

49 -32 = 17

*011*

17 -16 = 1

*0111*

1 -1 = 0

*01110001*

## Setting Bit-Mapped S-Registers

You can set bit-mapped S-Registers using either bits or decimal values. While it may be simpler for you to set the bits individually, your modem displays the S-Register settings in decimal form.

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## Using Bits

Turning individual bits on and off is the more direct way to set bit-mapped S-Registers. To do this, specify the S-Register that you want to set and then indicate which bits you want to turn on (1) or off (0).

Example: **`ATS13.0=1.4=1.5=1`**, turns bits 0, 4, and 5 on for S-Register 13.

## Using Decimal Values

An alternative way to set bit-mapped S-Registers is by adding the decimal values of the bits and entering the total.

This example, **`ATS13=49`**, sets the same value as the one in *Using Bits* above:

## Default S-Register Settings

The table below lists all default values for S-Register settings.

| S-Registers | Function | NVRAM Default Setting |
|---|---|---|
| S0 | Auto Answer | 0 |
| S1 | Counts & stores rings from incoming calls | 0 |
| S2 | Escape code character | 43 |
| S3 | Carriage Return character | 13 |
| S4 | Line Feed character | 10 |
| S5 | Backspace character | 8 |
| S7 | Carrier wait-time, sec | 60 |
| S8 | Dial pause, sec | 2 |
| S9 | Carrier Detect time, 100 ms | 6 |
| S10 | Carrier loss wait-time, 100 ms | 7 |
| S11 | Tone duration, spacing, ms | 70 |
| S12 | Escape code guard time, 500 ms | 50 |
| S13 | Bit-mapped functions* | 0 |
| S14 | Bit-mapped functions* | 0 |
| S15 | Bit-mapped functions* | 0 |
| S16 | Test modes | 0 |
| S18 | &T test timeout | 0 |
| S19 | Inactivity/hang up timer | 0 |

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| S-Registers | Function | NVRAM Default Setting |
|---|---|---|
| S21 | Break length, 10 ms | 10 |
| S22 | XON character | 17 |
| S23 | XOFF character | 19 |
| S24 | Pulsed DSR duration, 20 ms | 150 |
| S25 | DTR recognition time, 10 ms | 5 |
| S26 | RTS/CTS delay time, 10 ms | 1 |
| S27 | Bit-mapped functions* | 0 |
| S28 | V.32 handshake time, 100 ms | 8 |
| S29 | V.21 handshake time, 100 ms | 20 |
| S33 | Bit-mapped functions* | 0 |
| S34 | Bit-mapped functions* | 0 |
| S38 | Disconnect wait time, sec | 0 |
| S41 | Allowable remote log-in attempts | 0 |
| S42 | Remote Access ASCII character | 126 |
| S43 | Remote guard time, 200 ms | 200 |
| S51 | Bit-mapped functions* | 0 |
| S53 | Bit-mapped functions* | 0 |
| S54 | Bit-mapped functions* | 0 |
| S55 | Bit-mapped functions* | 0 |
| S56 | Bit-mapped functions* | 0 |
| S69 | Bit-mapped functions* | 0 |
| S70 | Bit-mapped functions* | 0 |

* Bit-mapped registers have up to eight functions.

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## A complete list of S-Registers

| Register | Default | Function |
|---|---|---|
| S0 | 0 | Sets the number of rings on which to answer in Auto Answer mode. S0=0 disables Auto Answer. S0=1 enables Auto Answer and the Business Modem answers on the first ring. |
| S1 | 0 | Counts and stores the number of rings from an incoming call. |
| S2 | 43 | Stores the ASCII decimal code for the escape code character. Default character is "+". A value of 128-255 disables the escape code. |
| S3 | 13 | Stores the ASCII decimal code for the Carriage Return character. Valid range is 0-127. |
| S4 | 10 | Stores the ASCII decimal code for the Line Feed character. Valid range is 0-127. |
| S5 | 8 | Stores the ASCII decimal code for the Backspace character. A value of 128-255 disables the Backspace key's delete function. |
| S6 | 0 | Set the number of seconds the Business Modem waits for a dial tone. |
| S7 | 60 | Sets the number of seconds the Business Modem waits for a carrier. May be set for much longer duration if, for example, the Business Modem is originating an international connection. |
| S8 | 2 | Sets the duration, in seconds, for the pause (,) option in the Dial command and the pause between command reexecutions (> and A> commands). |
| S9 | 6 | Sets the required duration, in tenths of a second, of the remote device's carrier signal before recognition by the Business Modem. |
| S10 | 14 | Sets the duration, in tenths of a second, that the Business Modem waits after loss of carrier before hanging up. This guard time allows the Business Modem to distinguish between a line hit, or other disturbance that momentarily breaks the connection, from a true disconnect (hanging up) by the remote device |
| S11 | 70 | Sets the duration and spacing, in milliseconds, of dialed tones. |
| S12 | 50 | Sets the duration, in fiftieths of a second, of the guard time for the escape code (+++) sequence. |

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| Register | Default | Function | | |
|---|---|---|---|---|
| S13 | 0 | Bit-mapped register. See the beginning of this appendix for information about setting bit-mapped registers. | | |
| | | **Bit** | **Value** | **Result** |
| | | 0 | 1 | Reset when DTR drops. |
| | | 1 | 2 | Reverse normal Auto Answer operation: On incoming RING, enter Originate Mode and look for an answer tone. |
| | | 2 | 4 | Disable 250 ms pause before result code display. |
| | | 3 | 8 | On DTR signal, autodial the number stored in NVRAM at position 0. |
| | | 4 | 16 | At power-on/reset, autodial number stored in NVRAM at position 0. |
| | | 5 | 32 | Disable HST (used for testing V.32terbo in Business Modems). |
| | | 6 | 64 | Disable MNP Level 3 (used for testing Level 2). |
| | | 7 | 128 | Hardware reset (works like powering off and then on). |
| S14 | 1 | Bit-mapped register (See the beginning of this appendix for information about setting bit-mapped registers). | | |
| | | **Bit** | **Value** | **Result** |
| | | 0 | 1 | Disconnect on escape code. |
| S15 | 0 | Bit-mapped register. (See the beginning of this appendix for information about setting bit-mapped registers). | | |
| | | **Bit** | **Value** | **Result** |
| | | 0 | 1 | Disable the Business Modem's extra high-frequency equalization if it causes problems on shorter-link calls for HST modulation only. |
| | | 1 | 2 | Disable online fallback. |
| | | 2 | 4 | Disable 450 bps back channel* HST only. |
| | | 3 | 8 | Reset non-ARQ mode Transmit buffer from 1.5K bytes to 128.* (for the convenience of BBS operators taking calls from remote users of slower modems). |

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| Register | Default | Function | | |
|---|---|---|---|---|
| | | 4 | 16 | Disable MNP Level 4; retransmitting the larger Level 4 data blocks may be a problem if you expect a great number of errors during a call. |
| | | 5 | 32 | Set Backspace key to delete. |
| | | 6 | 64 | Some earlier 2400 bps MNP modems, not made by 3Com or Microcom, were not fully compatible with the MNP protocol. If you have difficulty making a successful 2400 bps MNP connection with a remote MNP modem, it may be because of this incompatibility. Set S15 to 64 and try again to make the connection. |
| | | 7 | 128 | Custom applications only. |
| | | | | The default 1.5K byte non-ARQ buffer allows data transfer with X- and Y-modem type File Transfer Protocols without using flow control. |
| | | | | The 128-byte option allows remote users with slower modems to stop your transmitted data from scrolling off their screens. When remote users send your computer an XOFF (<Ctrl-S>) and you stop transmitting, the data in transit doesn't exceed the size of their screen. |
| S16 | 0 | Bit-mapped register. (See the beginning of this appendix for information about setting bit-mapped registers). For testing, see Chapter 15, Testing. | | |
| | | **Bit** | **Value** | **Result** |
| | | 1 | 2 | Dial Test |
| | | 2 | 4 | Test pattern. |
| | | 3 | 8 | Remote digital loopback. |
| S18 | 0 | Test timer for software-initiated loopback testing (&Tn); disabled when S18 is set to 0. Used to set the duration of testing, in seconds, before the Business Modem automatically times out and terminates the test. | | |

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| Register | Default | Function |
|---|---|---|
| S19 | 0 | Sets the duration, in minutes, for the Inactivity Timer. The timer activates when there is no data activity on the R232 interface, and at the timeout the Business Modem hangs up. S19=0 disables the timer. |
| S21 | 10 | Sets, in 10-millisecond units, the length of breaks sent from the Business Modem to the computer or terminal. Applies to ARQ mode only. |
| S22 | 17 | Stores the ASCII code for the XON character. |
| S23 | 19 | Stores the ASCII code for the XOFF character. |
| S24 | 150 | Sets the duration, in 20-millisecond units, between pulsed DSR signals when the Business Modem is set to &S2 or &S3. The default is 3 seconds. |
| S25 | 5 | Sets DTR recognition time in 10-millisecond units. |
| S27 | 0 | Bit-mapped register. (See the beginning of this appendix for information about setting bit-mapped registers). |

| Bit | Value | Result |
|---|---|---|
| 0 | 1 | Enable ITU-T V.21 modulation at 300 bps for overseas calls. In V.21 mode, the Business Modem answers both Bell 103 and V.21 calls, but only originates V.21 calls. |
| 1 | 2 | Enable unencoded (non-trelliscoded) modulation in V.32 mode; this option is part of the ITU-T V.32 recommendation, but is rarely used. |
| 2 | 4 | Disable V.32 modulation; used for testing HST modulation. |
| 3 | 8 | Disable 2100 Hz answer tone to allow two V.42 devices to connect more quickly. |
| 4 | 16 | See next page. |
| 5 | 32 | See next page. |
| 6 | 48 | Disable V.42 Detect Phase |
| 7 | 128 | Unusual software incompatibility. Some software may not accept some result codes. This setting disables the codes and displays the 9600 code instead. The call's actual rate can be viewed on the ATI6 screen. |

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<table>
<tr><th>Register</th><th>Default</th><th>Function</th></tr>
<tr><td></td><td></td><td>Error control handshaking options: Select the total value of bits 4 and 5
<table>
<tr><th>Bit 4</th><th>Bit 5</th><th>Result</th></tr>
<tr><td>0</td><td>0</td><td>Complete handshaking sequence: V.42 Detection, LAPM error control, MNP.</td></tr>
<tr><td>16</td><td>0</td><td>Disable MNP.</td></tr>
<tr><td>0</td><td>32</td><td>Disable V.42 Detection and LAPM.</td></tr>
<tr><td>16</td><td>32</td><td>Disable Detection phase, if you know that the remote Business Modem does LAPM, but not the Detection phase.</td></tr>
</table></td></tr>
<tr><td>S28</td><td>8</td><td>Sets the duration in tenths of a second of the extra 3000/600 Hz answer tones sent during V.32 hand-shaking. This gives V.32 modems additional time to connect in V.32 mode before timing out.<br><br>If there is difficulty answering older, manually operated V.32 modems (for example, modems that require a button to be pushed in order to dial, try lengthening the duration of the extra tones).Setting S28 to zero eliminates the extra tones resulting in a faster connect time if, for example, the Business Modem is set to use V.21 modulation (300 bps) or V.23 modulation (1200 bps).</td></tr>
<tr><td>S29</td><td>20</td><td>Sets the duration, in tenths of a second, of the V.21 answer tone.</td></tr>
<tr><td>S34</td><td>0</td><td>Bit-mapped register. See the beginning of this appendix for information about setting bit-mapped registers.
<table>
<tr><th>Bit</th><th>Value</th><th>Result</th></tr>
<tr><td>0</td><td>1</td><td>Disable V.32bis. Used for troubleshooting; 3Com Technical Support may ask you to disable V.32bis for testing purposes.</td></tr>
<tr><td>1</td><td>2</td><td>Disable the Business Modem's enhanced, proprietary V.32bis modulation. Used for troubleshooting.</td></tr>
<tr><td>2</td><td>4</td><td>Disable the faster retrains that occur during proprietary V.32terbo modulation. Used for troubleshooting.</td></tr>
<tr><td>3</td><td>8</td><td>Enable V.23. Required for some British connections.</td></tr>
</table></td></tr>
</table>

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| Register | Default | Function | | |
|---|---|---|---|---|
| | | 4 | 16 | Change MR to DSR |
| | | 6 | 64 | Disable the remote-access busy message. |
| | | 7 | 128 | Disable V.32*terbo*. |
| S38 | 0 | Sets the duration, in seconds, before a forced hang-up and clearing of the Transmit buffer when DTR drops during an ARQ call.<br>This is provided to allow time for a remote device to acknowledge receipt of all transmitted data. Default = 0: The Business Modem immediately hangs up when DTR drops. If the Business Modem receives the ATH command, it ignores S38 and immediately hangs up. | | |
| S41 | 0 | Sets the number of allowable remote-access login attempts, thus enabling or disabling remote access.<br>The default setting of zero allows no remote login attempts, disabling remote access. A value of 1 or greater enables remote access. If the number of unsuccessful login attempts exceeds the limit set by this register, the Business Modem returns online and any further login attempts during the remainder of that connection are refused. | | |
| S42 | 126 | Stores the ASCII decimal code for the remote-access escape character. The default character is a tilde (~). | | |
| S43 | 200 | Sets the duration, in fiftieths of a second, of the guard time for the remote-access (~~~~) sequence. | | |
| S44 | 15 | Sets the duration, in seconds, of the interval between losing carrier and reestablishing a connection. | | |
| S51 | 0 | Bit-mapped register. See the beginning of this appendix for information about setting bit-mapped registers. | | |
| | | **Bit** | **Value** | **Result** |
| | | 0 | 1 | Disable MNP/V.42 for V.22 (1200 bps) |
| | | 1 | 2 | Disable MNP/V.42 for V.22bis (2400 bps) |
| | | 2 | 4 | Disable MNP/V.42 for V.32/V.32bis/V.32terbo (9600/14400/19200/21600 bps). |
| | | 6 | 64 | Disable Selective Reject |
| S53 | 126 | Bit-mapped register. (See the beginning of this appendix for information about setting bit-mapped registers). | | |
| | | **Bit** | **Value** | **Result** |

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| Register | Default | Function | | |
|---|---|---|---|---|
| | | 0 | 1 | Dial security enabled. |
| | | 1 | 2 | Prompting enabled. |
| | | 2 | 4 | Local-access password protection enabled. |

*Enabling local-access password protection disables the &Zn=s command (which stores up to 10 phone numbers) because stored phone numbers occupy the same space in NVRAM as the dialback numbers for Dial Security accounts.*

| | | | | |
|---|---|---|---|---|
| S54 | 64 | Symbol rate bit-mapped register used primarily by 3Com Technical Support for debugging purposes. | | |
| | | **Bit** | **Value** | **Result** |
| | | 0 | 1 | Disable 2400 symbol rate. |
| | | 1 | 2 | Disable 2743 symbol rate. |
| | | 2 | 4 | Disable 2800 symbol rate. |
| | | 3 | 8 | Disable 3000 symbol rate. |
| | | 4 | 16 | Disable 3200 symbol rate. |
| | | 5 | 32 | Disable 3429 symbol rate. |
| | | 6 | 64 | Disable Call Indicate (CI). |
| | | 7 | 128 | Disable V.8. |
| S55 | 0 | Trellis code bit-mapped register used primarily by 3Com Technical Support for debugging purposes. | | |
| | | **Bit** | **Value** | **Result** |
| | | 0 | 1 | Disable 8S-2D mapping. |
| | | 1 | 2 | Disable 16S-4D mapping. |
| | | 2 | 4 | Disable 32S-2D mapping. |
| | | 3 | 8 | Disable 64S-4D mapping. |
| | | 7 | 128 | Enable phase roll detection |
| S56 | 0 | Bit-mapped register primarily used by 3Com Technical Support for debugging purposes. | | |
| | | **Bit** | **Value** | **Result** |
| | | 0 | 1 | Disable non-linear coding. |
| | | 1 | 2 | Disable TX level deviation. |

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| Register | Default | Function | | |
|---|---|---|---|---|
| | | 2 | 4 | Disable preemphasis. |
| | | 3 | 8 | Disable precoding. |
| | | 4 | 16 | Disable shaping. |
| | | 5 | 32 | Disable V.34+ |
| | | 6 | 64 | Disable V.34. |
| | | 7 | 128 | Disable V.FC. |
| S58 | 0 | Bit-mapped register. See the beginning of this appendix for information about setting bit-mapped registers. | | |
| | | **Bit** | **Value** | **Result** |
| | | 0 | 1 | Disable x2 |
| | | 5 | 32 | Enables/Disables V.90 |
| S69 | 0 | Bit-mapped register. (See the beginning of this appendix for information about setting bit-mapped registers). | | |
| | | **Bit** | **Value** | **Result** |
| | | 0 | 1 | Disable Plug and Play signaling. |
| | | 1 | 2 | Disable Multi-link Tones |
| S70 | 0 | Bit-mapped Register. See the beginning of this appendix for information about setting bit-mapped registers. | | |
| | | **Bit** | **Value** | **Result** |
| | | 0 | 1 | Enable recognition of Ring A |
| | | 1 | 2 | Enable recognition of Ring B |
| | | 2 | 4 | Enable recognition of Ring C |
| | | 3 | 8 | Enable recognition of Ring D |

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# B

# ALPHABETIC COMMAND SUMMARY

This appendix contains an alphabetic listing of the AT commands to which the modem will respond. Default settings are **bold**.

## Basic Command Set

| Command | Function |
|---|---|
| $ | Display help for the Basic command set. |
| +++ | Escape code. Once your modem is online with another device, the only command it recognizes is an escape code of three typed plus signs, which forces the modem back to Command mode. Do the following when issuing the command:<br>**1** Wait 1 second after sending the last item of data.<br>**2** Type **+++**<br>**3** Wait 1 second before typing any data.<br>When you type +++, the modem will either hang up or stay on line, depending on how you set S14. |
| > | Repeat command. If you include the repeat command in the Dial string, the modem will dial the number and wait 60 seconds for a carrier.<br>If the line is busy, the modem will pause for 2 seconds and then redial. The modem makes a maximum of 10 attempts. |
| A/ | Reexecute the last-issued command. DO NOT type AT or press Enter. |
| A> | Repeat the last-issued command until canceled by pressing any key. DO NOT type AT or press Enter. |
| AT | Attention prefix: informs a modem that a command is coming. AT must precede all commands except A/, A>, and +++. |
| A | Force a modem to answer when it is not receiving an incoming call. |

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| Command | Function | |
|---|---|---|
| Bn | Set handshaking options. | |
| | **B1** | Bell answer tone. This setting selects HST modulation, but use it only if the modem is not required to answer V.34-type calls. |
| Cn | Enable or disable the transmitter. | |
| | C0 | Transmitter disabled; for receiving only. |
| | **C1** | Transmitter enabled. |

*With the exception of the Dial options, modems ignore any commands issued after D in the same command string.*

| Command | Function | |
|---|---|---|
| Dn | Dial a phone number and issue other optional commands.<br>The numbers 0-9 are accepted. The maximum number of characters allowed is 36, including the AT prefix, punctuation, and spaces.<br>Optional parameters: | |
| | P | Dial using pulses. Accepted but ignored. |
| | T | Dial using tones. Accepted but ignored. |
| | , | (Comma) Pause for 2 seconds (or the time in S-Register 8). Accepted but ignored. |
| | ; | (Semicolon) Remain in Command mode after dialing. |
| | " | Dial the letters that follow. |
| | W | Wait for a second dial tone before continuing dialing (with X3 or higher). Accepted but ignored. |
| | @ | Wait for an answer (with X3, X4, or X7). Accepted but ignored. |
| | / | Pause for 125 milliseconds. Accepted but ignored. |
| | R | Reverse frequencies. Use this command when calling an originate-only modem. It forces the modem to dial out at the answer frequency. |

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| | | |
|---|---|---|
| | ! | Flash the switchhook (off hook 0.5 seconds, on hook 0.5 seconds, then off hook). Use ! when other modems share the line. |
| | L? | Display the last-dialed number. |
| | L | Dial the last-dialed number. |
| Sn | Dial the number stored in memory at position n, where n = 0-9. Store the number in memory using the &Z command. | |
| $ | Display help for the dial commands. | |
| En | Command mode echo. Enables or disables the display of your typed commands. | |
| | E0 | Command mode echo OFF. Your typing will not appear on the screen. |
| | **E1** | Command mode echo ON. Your typing will appear on the screen. |

*If double characters appear on the screen, both the modem's local echo and your software's local echo are on.*

| **Command** | **Function** | |
|---|---|---|
| Fn | Online local echo. If ON, a modem displays on your screen the data that it is transmitting to another modem. | |
| | F0 | Online echo ON. (Sometimes called half duplex.) |
| | **F1** | Online echo OFF. (Sometimes called full duplex.) |
| Hn | Go on or off hook. | |
| | H0 | Go on hook (hang up). |
| | H1 | Go off hook (pick up) |
| In | Query the modem. | |
| | I3 | Displays the banner (product name). |
| | I4 | Display current modem settings. |
| | I5 | Display settings stored in NVRAM. |
| | I6 | Display statistics for the last call. |
| | I7 | Display product configuration. |
| | I10 | Display dial security account status information. |
| | I11 | Display connection report (contains symbol rates). |
| | I15 | Display caller ID information. |

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| Command | Function | |
|---|---|---|
| Kn | Control the modem clock. ATI6 displays the time. | |
| | **K0** | If online, display current call duration. If offline, display last call's duration. |
| | K1 | Display the actual time. Set the clock using ATI3=HH:MM:SS K1. |
| Mn | Control when the speaker sounds | |
| | M0 | The speaker is always off. |
| | **M1** | The speaker is on until the call is negotiated. |
| | M2 | The speaker is always on. |
| | M3 | The speaker turns on after the last digit is dialed and stays on until the call is negotiated. |
| On | Return online. Use with the escape code (+++) to toggle between command and online modes. | |
| | O0 | Return online (normal). |
| | O1 | Return online and retrain. Use O1 if there were errors in a non-ARQ data transfer. |
| Qn | Enable or disable the display of result codes. | |
| | **Q0** | Display result codes. |
| | Q1 | Suppress result codes (quiet). |
| | Q2 | Suppress result codes when answering. |
| S$ | Display help screens for the S-Registers. | |
| Sr=n | Set S-Register value: r is any S-Register; n must be a decimal number between 0 and 255. | |
| Sr.b=n | Set a bit-mapped register: r is the S-register, b is the bit, and n is 0 (off) or 1 (on). | |
| Sr? | Query contents of S-register r. | |

*See Appendix A,* S-Registers *for a listing of all the S-Registers.*

| Command | Function | |
|---|---|---|
| Vn | Display result codes in words or numbers. | |
| | V0 | Display result codes in numeric form. |
| | **V1** | Display result codes in verbal form. |
| Xn | Control the amount of information displayed in the result codes. The default is X7 (all codes except 12/VOICE). | |

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| Command | Function | |
|---|---|---|
| | X3 | Ignore Dial Tone |
| | X4 | Microsoft default |
| | X7 | Business Modem default |
| Z | Software reset. Pressing the RESET button on the rear panel of the modem resets the modem to the &F0 configuration template (no flow control). | |

## Ampersand (&) Command Set

| Command | Function | |
|---|---|---|
| &$ | Display help for the ampersand (&) command set. | |
| &An | Enable or disable the display of additional result code subsets. (Also, see the Xn command.) | |
| | &A0 | Do not display ARQ result codes. |
| | &A1 | Display ARQ result codes. |
| | &A2 | In addition to ARQ result codes, display HST, V.32, V.FC, or V.34 modulation indicator. |
| | **&A3** | In addition to ARQ and modulation indicators, display an error control indicator (LAPM, HST, MNP, or NONE) and a data compression type (V42*bis* or MNP5). |
| &Bn | Set the serial port rate to variable or fixed. | |
| | &B0 | Variable: The serial port rate adapts to match the speed of the connection. |
| | **&B1** | Fixed: The modem always communicates with your computer at the rate at which you have set, regardless of the connection rate. |
| | &B2 | When answering calls, use the fixed rate for ARQ calls and variable rates for non-ARQ calls. |

*The serial port rate MUST be equal to or higher than the &Nn rate.*

| Command | Function | |
|---|---|---|
| &Cn | Controls how the modem sends a Carrier Detect (CD) signal to your computer. | |
| | &C0 | CD always ON, even if the modem is not on line. |

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| Command | Function | |
|---|---|---|
| | **&C1** | Normal operations. The modem sends a CD signal when it connects with another modem and drops the CD when it disconnects. |
| &Dn | Control how the modem responds to Data Terminal Ready (DTR) signals. | |
| | &D0 | DTR is always ON (ignored). |
| | &D1 | If issued before connecting with another device, the Business Modem can enter online Command mode during a call by dropping DTR.<br>&D1 functions similarly to the escape code (+++).<br>Return online with the On command, or hang up with the Hn command. |
| | **&D2** | Normal DTR operations. The modem will not accept commands unless your computer sends a DTR signal. Dropping DTR ends a call. |
| | &D2S13=1 | Modem resets with DTR toggle |
| &Fn | Load one of the three configuration templates that are stored permanently in read-only memory. Appendix C, *Flow Control Templates*, lists the settings for each template.<br>To load a template into current memory, enter AT&Fn. To write a template to NVRAM, enter AT&Fn&W.<br>&F0 is always loaded into memory at power-on or when the RESET button is pressed. | |
| | &F0 | Load No Flow Control template settings. |
| | **&F1** | Load Hardware Flow Control template settings. |
| | &F2 | Load Software Flow Control template settings. |
| &Gn | Set guard tones for international calls. | |
| | **&G0** | No guard tone. Use this in the United States and Canada. |
| | &G1 | This sets a 550 Hz guard tone, and is used in some European countries. |
| | &G2 | This sets an 1800 Hz guard tone, and is used in the U.K. and some Commonwealth countries. &G2 requires the B0 setting. |
| &Hn | Transmit data flow control. Prevents the modem's buffer for data transmitted to the modem by its attached computer from overflowing. | |
| | &H0 | Disable transmit data flow control. |

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| Command | Function | |
|---|---|---|
| | **&H1** | Use hardware flow control. Requires that your computer and software support Clear to Send (CTS) at the EIA-232 interface. |
| | &H2 | Use software flow control. Requires that your software support XON/XOFF signaling. |
| | &H3 | Use both hardware and software flow control. If you are unsure about what your equipment supports, select this option. |
| &In | Received data software flow (XON/OFF) control. | |
| | **&I0** | Disables XON/XOFF flow control of received data. |
| | &I1 | The modem acts on your typed XON/XOFF commands, Ctrl-S or Ctrl-Q, and passes them to the remote device. |
| | &I2 | The modem acts on your XON/XOFF commands, but removes them from the data stream instead of passing them to the remote device. This is the recommended setting for ARQ mode. |
| | &I3 | Hewlett Packard-Host mode. Applies only to modems attached to an HP mainframe that uses the ENQ/ACK protocol. Use in ARQ mode only. |
| | &I4 | Hewlett Packard-Terminal mode. Applies only to modems attached to terminals in an HP system that uses the ENQ/ACK protocol. Use in ARQ mode only. |
| | &I5 | This setting is designed to enable flow control on the phone link when the connection is not under error control. For this to work, the remote device must have &I5 capability. |
| &Kn | Enable or disable data compression. | |
| | &K0 | Disable data compression. |
| | **&K1** | Use auto-enable/disable. The modem enables compression if the serial port rate is fixed (&B1) and disables compression if the serial port rate follows the connection rate (&B0) because compression offers no throughput advantage when the serial port and connection rates are equal; in fact, compression may degrade throughput. |
| | &K2 | Always enable data compression. |

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| Command | Function | |
|---|---|---|
| | &K3 | Selective data compression. The modem negotiates only for V.42bis compression, and disables MNP Level 5 (MNP5) compression. Use this setting to transfer compressed files. |
| &Ln | Line type. | |
| | **&L0** | Normal. |
| &Mn | Enable ARQ (error control) protocol. Both your modem and the remote device must use the same protocol. | |
| | &M0 | Normal mode, no error control. Due to the nature of phone line channels, this is never recommended for calls above 2400 bps. |
| | **&M4** | Normal/ARQ mode. If an ARQ connection isn't made, the modem operates in Normal mode as though it were set to &M0. |
| &Nn | Sets fixed link speed. | |
| &Nn&UN | Sets highest and lowest link speeds | |
| | **n=1** | Variable rate. The modem negotiates with the remote device for the highest possible connection rate, depending on the capabilities of the remote device. |
| | n = 1 -16 | Fixed rate. The modem connects only if the remote device is operating at the same rate. You can use this feature to filter out calls at other than a specific rate for security or other reasons.<br>The connection rate must always be lower than or equal to the serial port rate. |
| | | n=1 300 bps<br>n=2 1200 bps<br>n=3 2400 bps<br>n=4 4800 bps<br>n=5 7200 bps<br>n=6 9600 bps<br>n=7 12000 bps<br>n=8 14400 bps<br>n=9 16800 bps<br>n=10 19200 bps<br>n=11 21600 bps<br>n=12 24000 bps |

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| Command | Function | | |
|---|---|---|---|
| | | n=13 | 26400 bps |
| | | n=14 | 28800 bps |
| | | n=15 | 31200 bps |
| | | n=16 | 33600 bps |
| | | n=17 | 28000 bps |
| | | n=18 | 29333 bps |
| | | n=19 | 30666 bps |
| | | n=20 | 32000 bps |
| | | n=21 | 33333 bps |
| | | n=22 | 34666 bps |
| | | n=23 | 36000 bps |
| | | n=24 | 37333 bps |
| | | n=25 | 38666 bps |
| | | n=26 | 40000 bps |
| | | n=27 | 41333 bps |
| | | n=28 | 42666 bps |
| | | n=29 | 44000 bps |
| | | n=30 | 45333 bps |
| | | n=31 | 46666 bps |
| | | n=32 | 48000 bps |
| | | n=33 | 49333 bps |
| | | n=34 | 50666 bps |
| | | n=35 | 52000 bps |
| | | n=36 | 53333 bps |
| | | n=37 | 54666 bps |
| | | n=38 | 56000 bps |
| | | n=39 | 57333 bps |
| &Rn | Received data (RTS) hardware flow control. | | |
| | &R0 | Delay Clear to Send (CTS) response after Request to Send (RTS). | |
| | &R1 | Ignore RTS. This setting is required if your computer or terminal or software does not support RTS. | |

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| Command | Function | |
|---|---|---|
| | **&R2** | Enable hardware flow control of received data. The modem sends data to the computer only upon receipt of the RTS signal. |
| &Sn | Send the computer a Data Set Ready (DSR) signal via the EIA-232 interface. ("Data Set" is industry jargon for modem.) | |
| | **&S0** | DSR is always ON (override). |
| | &S1 | In Originate mode: Send DSR after dialing, on detection of the remote device's answer tone. In Answer mode: Send DSR after sending an answer tone. |
| | &S2 | When Carrier is lost, send a pulsed DSR signal with Clear to Send (CTS) following Carrier Detect (CD). This option is for specialized equipment such as automatic callback units. |
| | &S3 | Same as &S2, but without the CTS signal. |
| | &S4 | Send the computer DSR at the same time as CD. |
| | &S5 | Send DSR normally, and follow CTS with CD. |
| &Tn | Test the modem. | |
| | &T0 | End testing. |
| | &T1 | Enter Analog Loopback (AL) mode. Your modem will send a CONNECT message. Data is shown on your screen. |
| | &T2 | Enter AL mode and send a CONNECT message. The Business Modem sends an internal test pattern to the transmitter and loops the pattern back to the receiver. No data is seen on your screen. |
| | &T3 | Start local digital loopback testing. |
| | &T4 | Grant a remote digital loopback test of your modem. |
| | **&T5** | Deny a remote digital loopback test of your modem. |
| | &T6 | Start remote digital loopback testing. |
| | &T7 | Start remote digital loopback with self-test and error detection. |
| &Wn | Write the current settings to NVRAM. | |
| &Yn | Break handling. This command lets you send a break to stop data transfer without disconnecting. | |

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| Command | Function | |
|---|---|---|
| | &Y0 | Destructive, don't send break. |
| | **&Y1** | Destructive, expedited. |
| | &Y2 | Nondestructive, expedited. |
| | &Y3 | Nondestructive, unexpedited; the modem sends a break-in-sequence with data received from your computer or terminal. |

*If the call is under MNP5 data compression, destructive breaks cause both modems to reset their data compression tables. When transmission resumes, the modems build new tables, and the result is lower-than-normal throughput.*

| Command | Function |
|---|---|
| &Zn=s | Store up to 10 numbers in NVRAM, where n is the position 0-9 in NVRAM, and s is the phone number string. The number string may be up to 36 characters long, including any Dial command options.<br>Example: **AT&Z2=555-6789**<br>In the following example, &M0 (no error control) is inserted before the Dial command: **AT&M0 DS2** |

*This command functions differently when Dial Security is enabled.*

*Also, do not include modem settings in the &Zn string. If the call requires a special setting, insert it in the command string before the DSn command.*

| | |
|---|---|
| &Zn=L | Stores the last-dialed number in position n. |
| &Zn? | Display the phone number stored in NVRAM at position n (where n = 0-9). |
| &ZC=s | Store command string s in NVRAM. The command string can be up to 30 characters long; spaced do not count. This command is used so you can call another modem without loading your communications software. |
| &ZC? | Display the stored command string. |

## Percent (%) Command Set

| Command | Function |
|---|---|
| %$ | Display the help panels for the percent (%) command set. |

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| Command | Function | |
|---|---|---|
| %An | Create and configure security accounts. | |
| %Bn | Remotely configure a modem's serial port rate. | |
| | %B0 | 110 bps |
| | %B1 | 300 bps |
| | %B2 | 600 bps |
| | %B3 | 1200 bps |
| | %B4 | 2400 bps |
| | %B5 | 4800 bps |
| | %B6 | 9600 bps |
| | %B7 | 19200 bps |
| | %B8 | 38400 bps |
| | %B9 | 57600 bps |
| | %B10 | 115200 bps |
| %Cn | Remote configuration control. | |
| | **%C0** | Defer configuration changes until the call is ended. Changes take effect for ensuing connections. |
| | %C1 | Cancel configuration changes and restore the original configuration. |
| | *Using%C1 will not reverse any changes that you wrote to NVRAM (with &W) or forced (with%C2).* | |
| | %C2 | Force configuration changes to take effect immediately. |

*We recommend against forcing configuration changes unless it is absolutely necessary. An unreliable connection, or loss of connection, may result.*

| Command | Function | |
|---|---|---|
| %E=n | Erase security settings. | |
| | %E=1 | Erase local-access password. |
| | %E=2 | Erase Autopass password. |
| | %E=3 | Erase passwords in accounts 0-9. |
| | %E=4 | Erase phone numbers in accounts 0-9. |
| | %E=5 | Disable Account, Dialback, and New Number fields in accounts 0-9. |

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| Command | Function | |
|---|---|---|
| %Fn | Remotely configure another device's data format. | |
| | %F0 | No parity, 8 data bits. |
| | %F1 | Mark parity, 7 data bits. |
| | %F2 | Odd parity, 7 data bits. |
| | %F3 | Even parity, 7 data bits. |
| %L= | Set a local-access password. | |
| %Pn= | Disable password security (n=0 or n=1) when no character follows the equal sign. | |
| %Pn=s | Set the following password (s) for viewing privileges only (n = 0), or view and configuration privileges (n= 1). | |
| %Pn? | Display password n. | |
| %S=n | Access the security accounts. Does not disable security. | |
| %T | Enable the recognition of tone frequencies of analog dialing devices.%T is meant primarily for use with network applications, but may also be integrated into certain software programs. For example, %T could be used in a security program to identify incoming tone security codes.<br>To return the modem to Command mode, press any key or drop the computer's or terminal's DTR signal. The modem responds OK | |
| %V=PWn | Assign the password in account n in your modem's security account as your Autopass password | |

## Octothorpe (#) Command Set

| Command | Function | |
|---|---|---|
| #$ | Display the help panels for the octothorpe (#) command set. | |
| #CID=n | Controls the caller ID settings. | |
| | **#CID=0** | Disable caller ID detection and reporting. |
| | #CID=1 | Enable caller ID with formatted output. |
| | #CID=2 | Enable caller ID with unformatted output. |
| | #CID=3 | Enable caller ID with formatted output and name suppressed. |
| | #CID=4 | Enable caller ID but do not transmit the information to your computer- retain it in the modem's memory. |
| #CID? | Display the current caller ID settings. | |
| #CID=? | Display the caller ID actions that are available. | |

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# C

# FLOW CONTROL TEMPLATE

## Hardware Flow Control

The table below lists the Hardware flow control template. To load this template send **AT&F1** to your modem.

| NVRAM Options | Setting | Description |
|---|---|---|
| Handshake option | B0 | ITU-T answer sequence |
| Transmitter | C1 | Enabled |
| Command mode echo | E1 | Enabled |
| Online local echo | F1 | Disabled |
| Training tone volume | L2 | Medium |
| Speaker control | M1 | ON during dial through connect |
| Result codes | Q0 | Enabled |
| Verbal or numeric result codes | V1 | Verbal result codes |
| Result code subset | **X7** | **Extended. Includes all codes except VOICE** |
| Protocol response codes | &A3 | Full protocol codes |
| Serial port rate select | &B1 | Serial port rate fixed higher than connect rate |
| Carrier Detect | &C1 | Normal operations |
| Data Terminal REady | &D2 | Normal operations |
| Guard tone | &G0 | U.S./Canada |
| Transmit data hardware flow control | **&H1** | **Hardware flow control** |
| Record data software flow control | **&I0** | **Disabled** |
| Analog data compression | &K1 | Enabled |
| Normal lines | &L0 | Normal lines |

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| NVRAM Options | Setting | Description |
|---|---|---|
| Error control | &M4 | Normal/error control |
| Link rate select | &N0 | Variable |
| Pulse dialing type | &P0 | U.S./Canada |
| Record data hardware flow control | **&R2** | **Enabled** |
| Data Set Ready | &S0 | Always on |
| Remote Digital Loopback (RDL) | &T5 | Deny RDL |
| Break handling | &Y1 | Clear buffer, send immediately |
| Stored telephone number | &Z0-9=0 | Blank |
| Caller ID | #CID=0 | Caller ID disabled |
| Word length* | **8** | |
| Parity* | **0** | **None** |
| DTE rate* (Kbps) | **19.2** | _ |

* Detected by each modem from the AT prefix of the &W command that writes your defaults to NVRAM. Set your software to the desired word length, parity, and serial port rate defaults before sending the modem the AT... &W string.

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## Software Flow control

The table below lists the Software flow control template. To load this template send **AT&F2** to the modem.

| NVRAM Options | Setting | Description |
|---|---|---|
| Handshake option | B0 | ITU-T answer sequence |
| Transmitter | C1 | Enabled |
| Command mode echo | E1 | Enabled |
| Online local echo | F1 | Disabled |
| Training tone volume | L2 | Medium |
| Speaker control | M1 | ON during dial through connect |
| Result codes | Q0 | Enabled |
| Verbal or numeric result codes | V1 | Verbal result codes |
| Result code subset | **X7** | **Extended. Includes all codes except VOICE** |
| Protocol response codes | &A3 | Full protocol codes |
| Serial port rate select | &B1 | Serial port rate fixed higher than connect rate |
| Carrier Detect | &C1 | Normal operations |
| Guard tone | &G0 | U.S./Canada |
| Transmit data hardware flow control | **&H2** | **Software flow control** |
| Record data software flow control | **&I2** | **Enabled** |
| Analog data compression | &K1 | Enabled |
| Normal lines | &L0 | Normal lines |
| Error control | &M4 | Normal/error control |
| Link rate select | &N0 | Variable |
| Pulse dialing typE | &P0 | U.S./Canada |
| Record data hardware flow control | &R2 | Enabled |
| Data Set Ready | &S0 | Always on |
| Remote Digital Loopback (RDL) | &T5 | Deny RDL |
| Break handling | &Y1 | Clear buffer, send immediately |

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| NVRAM Options | Setting | Description |
|---|---|---|
| Stored telephone number | &Z0-9=0 | Blank |
| Caller ID | #CID=0 | Caller ID disabled |
| Word length* | **8** | |
| Parity* | **0** | **None** |
| DTE rate* (Kbps) | **19.2** | _ |

* Detected by each modem from the AT prefix of the &W command that writes your defaults to NVRAM. Set your software to the desired word length, parity, and serial port rate defaults before sending the modem the AT... &W string.

## No Flow Control

The table below lists the No flow control template. To load this template send **`AT&F0`** to the modem.

| NVRAM Options | Setting | Description |
|---|---|---|
| Handshake option | B0 | ITU-T answer sequence |
| Transmitter | C1 | Enabled |
| Command mode echo | E1 | Enabled |
| Online local echo | F1 | Disabled |
| Training tone volume | L2 | Medium |
| Speaker control | M1 | ON during dial through connect |
| Result codes | Q0 | Enabled |
| Verbal or numeric result codes | V1 | Verbal result codes |
| Result code subset | **X1** | **Basic** |
| Protocol response codes | &A3 | Full protocol codes |
| Serial port rate select | &B1 | Serial port rate fixed higher than connect rate |
| Carrier Detect | &C1 | Normal operations |
| Guard tone | &G0 | U.S./Canada |
| Transmit data hardware flow control | **&H0** | **Disabled** |

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| NVRAM Options | Setting | Description |
|---|---|---|
| Record data software flow control | **&I0** | **Disabled** |
| Analog data compression | &K1 | Enabled |
| Normal lines | &L0 | Normal lines |
| Error control | &M4 | Normal/error control |
| Link rate select | &N0 | Variable |
| Record data hardware flow control | **&R1** | **Disabled** |
| Data Set Ready | &S0 | Always on |
| Remote Digital Loopback (RDL) | &T5 | Deny RDL |
| Break handling | &Y1 | Clear buffer, send immediately |
| Stored telephone number | &Z0-9=0 | Blank |
| Word length* | **7** | |
| Parity* | **1** | **Even** |
| DTE rate* (Kbps) | **9600** | _ |

* Detected by each modem from the AT prefix of the &W command that writes your defaults to NVRAM. Set your software to the desired word length, parity, and serial port rate defaults before sending the modem the AT... &W string.

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# D

# Result Code Meanings and Sets

## Result Code Meanings

| Result Code | Meaning |
|---|---|
| 0/OK | Command has been executed. |
| 1/CONNECT | Connection with another device. |
| 2/RING | Incoming ring detected. |
| 3/NO CARRIER | Carrier Detect has failed, or carrier has been dropped due to disconnect. |
| 4/ERROR | Command is invalid. |
| 5/CONNECT 1200 | Connection at reported rate. Same meaning for results of 2400 (10), 4800 (18), 7200 (20), 9600 (13), 12000 (21), 14400 (25), 16800 (43), 19200 (85), 21600 (91), 24000 (99), 26400 (103), 28800 (107), 31200 (151), 33600 (155), 56000 (162), or 64000 (165) bps. |
| 6/NO DIAL TONE | Dial tone not detected during the default 2 seconds, set in Register S6. |
| 7/BUSY | Busy signal detect; modem hangs up. |
| 8/NO ANSWER | After waiting 5 seconds for an answer, modem hangs up; returned instead of NO CARRIER when the @ option is used. |
| 11/RINGING | The modem has dialed; remote phone line is ringing. |
| 12/VOICE | Voice answer at remote site; modem hangs up. |
| 170/RING A | Incoming distinctive ring detected. |
| 171/RING B | Incoming distinctive ring detected. |
| 172/RING C | Incoming distinctive ring detected. |
| 173/TING D | Incoming distinctive ring detected. |
| Wait for another Dial Tone (W) | Business Modem continues dialing as soon as it detects another dial tone. Requires X3 or higher. |
| Wait for an answer (@) | Business Modem continues dialing when it detects 5 seconds of silence on the line. Requires X3 or higher. |

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## Result Codes Sets for X*n* Values

| Result Codes | X0 | X1 | X2 | X3 | X4 | X5 | X6 | X7 |
|---|---|---|---|---|---|---|---|---|
| 0/OK | ● | ● | ● | ● | ● | ● | ● | ● |
| 1/CONNECT | ● | ● | ● | ● | ● | ● | ● | ● |
| 2/RING | ● | ● | ● | ● | ● | ● | ● | ● |
| 3/NO CARRIER | ● | ● | ● | ● | ● | ● | ● | ● |
| 4/ERROR | ● | ● | ● | ● | ● | ● | ● | ● |
| 5/CONNECT 1200 | | ● | ● | ● | ● | ● | ● | ● |
| 6/NO DIAL TONE | | | ● | | ● | | ● | ● |
| 7/BUSY | | | | ● | ● | ● | ● | ● |
| 8/NO ANSWER | | | | ● | ● | ● | ● | ● |
| 10/CONNECT 2400 | | ● | ● | ● | ● | ● | ● | ● |
| 11/RINGING | | | | | | ● | ● | ● |
| 12/VOICE | | | | | | ● | ● | |
| 13/CONNECT 9600 | | ● | ● | ● | ● | ● | ● | ● |
| 18/CONNECT 4800 | | ● | ● | ● | ● | ● | ● | ● |
| 20/CONNECT 7200 | | ● | ● | ● | ● | ● | ● | ● |
| 21/CONNECT 12000 | | ● | ● | ● | ● | ● | ● | ● |
| 25/CONNECT 14400 | | ● | ● | ● | ● | ● | ● | ● |
| 43/CONNECT 16800 | | ● | ● | ● | ● | ● | ● | ● |
| 85/CONNECT 19200 | | ● | ● | ● | ● | ● | ● | ● |
| 91/CONNECT 21600 | | ● | ● | ● | ● | ● | ● | ● |
| 99/CONNECT 24000 | | ● | ● | ● | ● | ● | ● | ● |
| 103/CONNECT 26400 | | ● | ● | ● | ● | ● | ● | ● |
| 107/CONNECT 28800 | | ● | ● | ● | ● | ● | ● | ● |
| 151/CONNECT 31200 | | ● | ● | ● | ● | ● | ● | ● |
| 155/CONNECT 33600 | | ● | ● | ● | ● | ● | ● | ● |
| 171/RING A | | ● | ● | ● | ● | ● | ● | ● |
| 172/RING B | | ● | ● | ● | ● | ● | ● | ● |
| 173/RING C | | ● | ● | ● | ● | ● | ● | ● |
| 174/RING D | | ● | ● | ● | ● | ● | ● | ● |
| **Functions** | | | | | | | | |
| Wait for 2nd Dial Tone (W) | | | | ● | ● | ● | ● | ● |
| Wait for Answer (@) | | | | ● | ● | ● | ● | ● |

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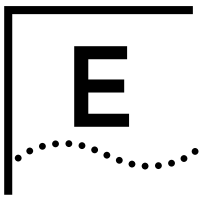

# TECHNICAL INFORMATION

## Technical Specifications

Your modem uses multiple standard data communications protocols and is also compatible with many nonstandard schemes. The following schemes are supported:

### Modulation

| This modulation | Supports |
|---|---|
| V.90 | ITU 56K standard, server capabilities. V.90 analog clients can call into your Business Modem to get 56K connections |
| x2 | Up to 56 Kbps downstream and V.34 speeds upstream |
| ITU-T V.34 | 33.6/31.2/28.8/26.4/24/21.6/19.2/16.8/14.4/12 kbps; 9600/7200/4800 bps asynchronous Trellis Coded Modulation (TCM) |
| V.FC | 28.8/26.4/24/21.6/19.2/16.8/14.4 kbps asynchronous TCM |
| V.32 *terbo* | 21.6/19.2/16.8/14.4/12 kbps; 9600/7200 bps asynchronous TCM; 4800 bps asynchronous Quadrature Amplitude Modulation (QAM) |
| HST | 16.8/14.4/12 kbps; 9600/7200 bps asynchronous, asymmetrical, 450 bps back channel with automatic handshake adjustment to 300 bps TCM and QAM; 4800 bps asynchronous, asymmetrical, 450 bps back channel with automatic handshake adjustment to 300 bps QAM. |
| ITU-T V.32 *bis* | 14.4/12 kbps; 9600/7200 bps asynchronous TCM; 4800 bps asynchronous QAM |
| ITU-T V.32 | 9600 bps asynchronous, TCM; 4800 bps asynchronous, QAM |
| ITU-T V.22 *bis* | 2400 bps asynchronous, QAM |
| Bell 212A | 1200 bps (also V.22) asynchronous, Differential Phase Shift Keying (DPSK) |

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| This modulation | Supports |
|---|---|
| ITU-T V.23 | 1200 bps asymmetrical with 75 bps back channel with Frequency Shift Keying (FSK), used by some U.K. and European phone systems. |
| Bell 103 | 300 bps (ITU-T V.21 optional) asynchronous, Frequency Shift Keying (FSK) |

## Error Control, Data Compression, Testing, and Dialing

| This | Supports |
|---|---|
| ITU-T V.42 | LAPM error control, 1200 bps and higher |
| MNP | Levels 2, 3 and 4 error control, level 5 data compression, 1200 bps and higher |
| HST | Asymmetrical mode, at 16.8/14.4/12 kbps; 9600/ 7200/4800 bps, 450/300 bps back channel |
| ITU-T V.42 *bis* | Data compression, 1200 bps and higher |
| ITU-T V.54 | Digital and remote digital loopback testing |

**Fax** Your Business Modem provides Group III -compatibility when controlled by Class 1 or Class 2.0 fax software. In addition, your Business Modem adheres to the following standards:

| This | Supports |
|---|---|
| TIA/EIA-578 | Service Class 1 Asynchronous Facsimile DCE Control Standard |
| TIA/EIA-592 | Service Class 2.0 Asynchronous Facsimile DCE Control Standard |
| ITU-T V.17 | 14.4/12 kbps |
| ITU-T V.29 | 9600/7200 bps |
| ITU-T V.27 *ter* | 4800/2400 bps |
| ITU-T V.21 | 300 bps |

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## Additional Specifications

| This feature | Supports | | |
|---|---|---|---|
| Supported serial port rates | 230400, 115200, 57600, 38400, 19200, 9600, 4800, 2400, 1200, and 300 bps | | |
| Adaptive Speed Leveling (ASL) | 21600, 19200, 16800, 14400, 12000, 9600, 7200, and 4800 bps | | |
| Serial port connector | DB-25 | | |
| Communications channel | Full- or half- duplex on 2-wire phone lines; demand-driven high-speed turnaround in HST mode; symmetrical speeds in V.32 *bis*. | | |
| Data format | Binary, serial; defaults to 8-bit word length, no parity, and 1 stop bit. | | |
| | **Word Length** | **Parity (1 Bit)** | **Stop Bits** |
| | 7 | Even, odd, mark, space | 1 |
| | 7 | None | 2 |
| | 8 | None | 1 |
| Flow Control Buffers | Variable sizes | | |
| Command Buffer | 56 characters, excluding the AT prefix, Carriage Return, and spaces | | |
| Test Options | Remote digital loopback, digital loopback, test pattern, and dial test | | |
| Failed Call Timeout | 60 second default, programmable 2-255 sec. | | |
| Answer Tone Timeout | 60 seconds | | |
| Answer Tone Detector | 2080-2120 Hz | | |
| Loss of Carrier (Disconnect Timer) | 0.7 second default, programmable 0.2-25.5 sec. | | |
| Equalization | Adaptive | | |
| Receive Sensitivity | - 43 dBm + 2 dBm | | |
| Transmit Level | - 9 dBm maximum | | |
| Transmitter Frequency Tolerance | .01% | | |
| Certification | FCC Part 68 Part 15, Class B Domestic; IC (Canada) CS-03, UL listed | | |
| Ringer equivalence | 0.4b | | |

## Serial Ports

Most computers provide a DB-25 or DB-9 port that conforms to the EIA-232 standard. If you are connecting your Business Modem to a Macintosh computer, see the section For Macintosh Computers.

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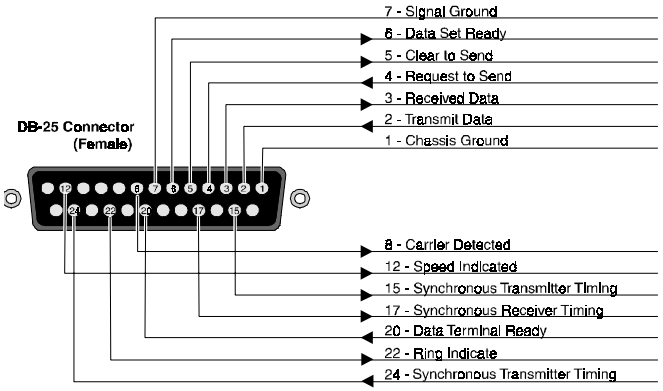
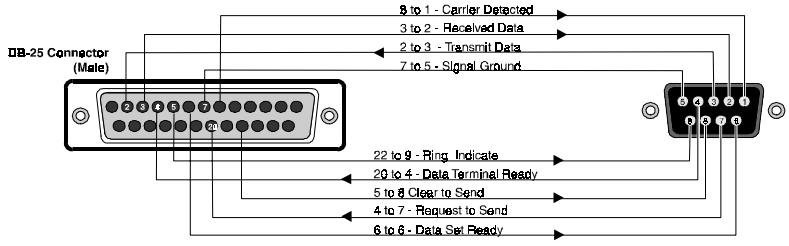
## The EIA-232 Interface

Your modem's serial port is factory set to signal according to the EIA-232 standard. See Figure A-1, Signals at your Business Modem's Serial Port.


DB-25 Connector
(Female)
7 - Signal Ground
6 - Data Set Ready
5 - Clear to Send
4 - Request to Send
3 - Received Data
2 - Transmit Data
1 - Chassis Ground
8 - Carrier Detected
12 - Speed Indicated
15 - Synchronous Transmitter Timing
17 - Synchronous Receiver Timing
20 - Data Terminal Ready
22 - Ring Indicate
24 - Synchronous Transmitter Timing

## Wiring a DB-25 to DB-9 Cable

DB-9 connectors for PCs should be wired at the computer end of the cable as shown below.


DB-25 Connector
(Male)
8 to 1 - Carrier Detected
3 to 2 - Received Data
2 to 3 - Transmit Data
7 to 5 - Signal Ground
22 to 9 - Ring Indicate
20 to 4 - Data Terminal Ready
5 to 8 Clear to Send
4 to 7 - Request to Send
6 to 6 - Data Set Ready

## Minimum Requirements

Some computer/terminal equipment supports only a few of your modem's EIA-232 signals. The minimum required for your modem to operate asynchronously follows:

| DB-25 | DB-9 | Supports this signal |
|---|---|---|
| Pin | Pin | Function |
| 2 | 3 | Transmitted Data |
| 3 | 2 | Received Data |
| 7 | 5 | Signal Ground |
| 20 | 4 | Data Terminal Ready |

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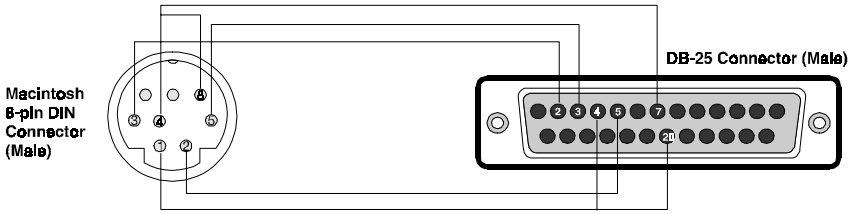
**Flow Control Requirements**

If your computer and software support Clear to Send and you wish to use Transmit Data hardware flow control (&H1), Pin 5 (DB-25) or Pin 8 (DB-9) is required.

If your computer and software support Request to Send and you wish to use Received Data hardware flow control (&R2), Pin 4 (DB-25) or Pin 7 (DB-9) is required.

**For Macintosh Computers**

If you're connecting your modem to a Macintosh computer, we strongly recommend that you purchase a hardware handshaking cable to get the most reliable performance.




| Mac Pin | Mac Pin Description | Modem Pin | Modem Pin Description |
|---|---|---|---|
| 1 | Output Handshake | 4, 20 | Request-to-Send and Data Terminal Ready |
| 2 | Input Handshake | 5 | Clear-to-Send |
| 3 | Transmit Data - | 2 | Transmit Data |
| 4 | Ground | 7 | Ground |
| 4, 8 | Ground to Received Data | | |
| 5 | Received Data - | 3 | Received Data |

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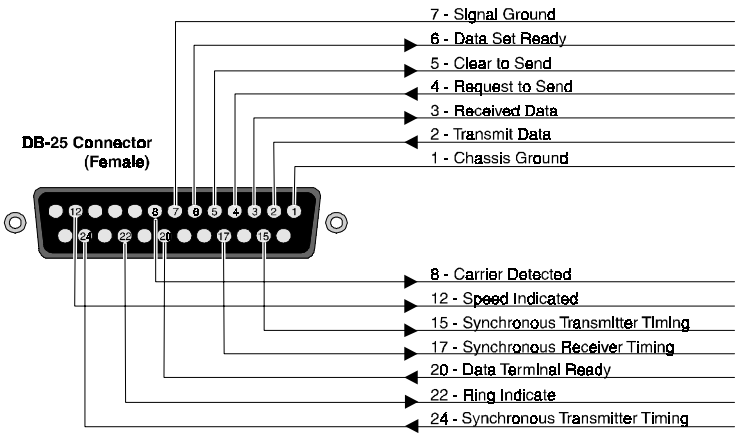
**Serial Ports (Macintosh modem)**

These are the signals generated or accepted by your modem's serial port:


DB-25 Connector
(Female)
7 - Signal Ground
6 - Data Set Ready
5 - Clear to Send
4 - Request to Send
3 - Received Data
2 - Transmit Data
1 - Chassis Ground
8 - Carrier Detected
12 - Speed Indicated
15 - Synchronous Transmitter Timing
17 - Synchronous Receiver Timing
20 - Data Terminal Ready
22 - Ring Indicate
24 - Synchronous Transmitter Timing

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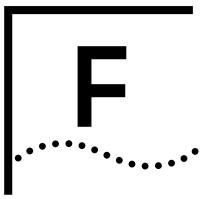

# ASCII CHART

| Dec | Hex | Char | Dec | Hex | Char | Dec | Hex | Char | Dec | Hex | Char |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 00 | 00 | NUL | 32 | 20 | SP | 64 | 40 | @ | 96 | 60 | ` |
| 01 | 01 | SOH | 33 | 21 | ! | 65 | 41 | A | 97 | 61 | a |
| 02 | 02 | STX | 34 | 22 |  | "66 | 42 | B | 98 | 62 | b |
| 03 | 03 | ETX | 35 | 23 | # | 67 | 43 | C | 99 | 63 | c |
| 04 | 04 | EOT | 36 | 24 | $ | 68 | 44 | D | 100 | 64 | d |
| 05 | 05 | ENQ | 37 | 25 | % | 69 | 45 | E | 101 | 65 | e |
| 06 | 06 | ACK | 38 | 26 | & | 70 | 46 | F | 102 | 66 | f |
| 07 | 07 | BEL | 39 | 27 | ë | 71 | 47 | G | 103 | 67 | g |
| 08 | 08 | BS | 40 | 28 | ( | 72 | 48 | H | 104 | 68 | h |
| 09 | 09 | HT | 41 | 29 | ) | 73 | 49 | I | 105 | 69 | I |
| 10 | 0A | LF | 42 | 2A | * | 74 | 4A | J | 106 | 6A | j |
| 11 | 0B | VT | 43 | 2B | + | 75 | 4B | K | 107 | 6B | k |
| 12 | 0C | FF | 44 | 2C | , | 76 | 4C | L | 108 | 6C | l |
| 13 | 0D | CR | 45 | 2D | - | 77 | 4D | M | 109 | 6D | m |
| 14 | 0E | SO | 46 | 2E | . | 78 | 4E | N | 110 | 6E | n |
| 15 | 0F | SI | 47 | 2F | / | 79 | 4F | O | 111 | 6F | o |
| 16 | 10 | DLE | 48 | 30 | 0 | 80 | 50 | P | 112 | 70 | p |
| 17 | 11 | XON | 49 | 31 | 1 | 81 | 51 | Q | 113 | 71 | q |
| 18 | 12 | DC2 | 50 | 32 | 2 | 82 | 52 | R | 114 | 72 | r |
| 19 | 13 | XOFF | 51 | 33 | 3 | 83 | 53 | S | 115 | 73 | s |
| 20 | 14 | DC4 | 52 | 34 | 4 | 84 | 54 | T | 116 | 74 | t |
| 21 | 15 | NAK | 53 | 35 | 5 | 85 | 55 | U | 117 | 75 | u |
| 22 | 16 | SYN | 54 | 36 | 6 | 86 | 56 | V | 118 | 76 | v |
| 23 | 17 | ETB | 55 | 37 | 7 | 87 | 57 | W | 119 | 77 | w |

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| Dec | Hex | Char | Dec | Hex | Char | Dec | Hex | Char | Dec | Hex | Char |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | 18 | CAN | 56 | 38 | 8 | 88 | 58 | X | 120 | 78 | x |
| 25 | 19 | EM | 57 | 39 | 9 | 89 | 59 | Y | 121 | 79 | y |
| 26 | 1A | SUB | 58 | 3A | : | 90 | 5A | Z | 122 | 7A | z |
| 27 | 1B | ESC | 59 | 3B | ; | 91 | 5B | [ | 123 | 7B | { |
| 28 | 1C | FS | 60 | 3C | < | 92 | 5C | \ | 124 | 7C | \| |
| 29 | 1D | GS | 61 | 3D | = | 93 | 5D | ] | 125 | 7D | } |
| 30 | 1E | RS | 62 | 3E | > | 94 | 5E | à | 126 | 7E | ~ |
| 31 | 1F | US | 63 | 3F | ? | 95 | 5F | _ | 127 | 7F | DEL |

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# G

# FAX INFORMATION FOR PROGRAMMERS

## Fax Service Class 1 Commands

| | |
|---|---|
| +FCLASS? | What mode is in use Data or Fax? |
| +FCLASS=n (0,1,2.0) | Class identification and control. |
| +FCLASS=? | What Fax class is in use? |
| +FTS=n (0,255) | Stop transmission and pause, 10 ms. |
| +FRS=n (0,255) | Wait for silence, 10 ms. |
| +FTM=n (3,24,48,72,73,74,96,121,122,145,146) | Transmit data with carrier. |
| +FRM=n (3,24,48,72,73,74,96,121,122,145,146) | Receive data with carrier. |
| +FTH=n (3,24,48,72,73,74,96,121,122,145,146) | Transmit HDLC data with carrier. |
| +FRH=n (3,24,48,72,73,74,96,121,122,145,146) | Receive HDLC data with carrier. |

## FAX Service Class 2.0 Commands

In addition to the standard Class 2.0 fax commands, 3Com implements the following optional Class 2.0 fax commands:

| | |
|---|---|
| +FNS=0,1 | Pass-through, nonstandard negotiation byte string |
| +FCR=0,1 | Capability to receive. |
| +FAA=0,1 | Adaptive Answer mode. |
| +FCT=0-255 sec. | Phase C Timeout |
| +FHS=0-255 | Hangup Status Code, read only. |
| +FMS=0-3 | Minimum Phase C Speed. |
| +FBS?=500,100 | Buffer size, read only. |

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## Fax Mode Flow Control Setting

Many facsimile software products use software flow control when the modem is in Fax mode. Throughout our documentation, we recommend that you use hardware flow control for Data mode (factory setting). However, to allow compatibility with software products that use software flow control by default, 3Com fax modems automatically change to software flow control when entering Fax mode.

## FCC Notice

FCC part 68, rules regarding fax operation, has been amended as follows:

Telephone facsimile machines identification of the sender of the message: It shall be unlawful for any person within the United States to use a computer or other electronic device to send any message via a telephone facsimile machine unless such a message clearly contains, in a margin at the top or bottom of each transmitted page or on the first page of the transmission, the date and time it is sent and an identification of the business, other entity, or individual sending the message and the telephone number of the sending machine or of such business, other entity, or individual. Telephone facsimile machines manufactured on and after December 20, 1992 must clearly mark such identifying information on each transmitted page.

## Notes

If you want to know more about the supported Class 1 fax commands, refer to the standard for the Service Class 1 fax protocol:

ANSI/EIA/TIA-578-1990 (EIA-578)

Asynchronous Facsimile DCE Control Standard

November, 1990  Approved: October 22, 1990

For more information on Class 2.0, refer to the standard for the Service Class 2.0 fax protocol:

ANSI/EIA/TIA-592-1993 (EIA-592)

Asynchronous Facsimile DCE Control Standard

May, 1993

You can obtain copies of these standards by contacting Global Engineering Documents at 1-800-854-7179.

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# H

# VIEWING LEDS

This appendix explains how to view the twelve LEDs on the front of your Business Modem.

| This LED | Status | Means your Business Modem |
|---|---|---|
| Alert | On | Has detected a firmware dowload error |
| | Flashing | Firmware update in progress |
| | Off | Normal operation |
| Power | On | Is switched on |
| | Off | is switched off |
| Fax | On | Is currently configured for fax operation |
| | Off | is not currently configured for fax operation |
| ARQ | On | Is making a data connection using an error control protocol |
| | Off | Is making a data connection without using an error control protocol |
| AA | On | Is ready to accept calls |
| | Blinking | Has detected an incoming call |
| | Off | Is not ready to accept calls |
| OH | On | Has control of the line |
| | Off | Does not have control of the line |
| TD | On | Is transmitting data |
| | Off | Is not transmitting data |
| RD | Flashing | Is sending data to your computer |
| | Off | Is idle |
| MR | On | Is powered on and ready or is receiving RS232 DSR signal |
| | Flashing | Is retraining with a remote device or is in Test mode |
| | Off | Is powered off |

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| This LED | Status | Means your Business Modem |
|---|---|---|
| TR | On | **RS232 mode:** has detected DTR signal |
| | | **USB mode:** has detected successful USB registration |
| | Off | **RS232 mode:** has not detected DTR |
| | | **USB mode:** has not detected successful USB registration |
| CD | On | Has detected a carrier from a remote device or carrier detect has been forced on |
| | Off | Has not detected a carrier |
| RS | On | Has detected the Ready to Send (RTS) signal from your computer |
| | Off | Has not detected the RTS signal from your computer |
| CS | On | Is sending your computer the Clear to Send (CTS) signal |
| | Off | Is not sending your computer the CTS signal |

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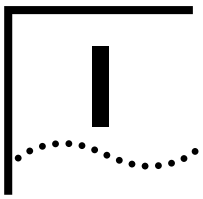

# S-REGISTERS

## S-Registers

S-Registers: Their Functions and Default Settings

| Register | Default | Function |
|---|---|---|
| S0 | 0 | Sets the number of rings on which to answer in Auto Answer mode. S0=0 disables Auto Answer. S0=1 enables Auto Answer and the Business Modem answers on the first ring. |
| S1 | 0 | Counts and stores the number of rings from an incoming call. |
| S2 | 43 | Stores the ASCII decimal code for the escape code character. Default character is "+". A value of 128-255 disables the escape code.* |
| S3 | 13 | Stores the ASCII decimal code for the Carriage Return character. Valid range is 0*127.* |
| S4 | 10 | Stores the ASCII decimal code for the Line Feed character. Valid range is 0*127.* |
| S5 | 8 | Stores the ASCII decimal code for the Backspace character. A value of 128-255 disables the Backspace key's delete function.* |
| S6 | 0 | Sets the number of seconds the Business Modem waits for a dial tone. |
| S7 | 60 | Sets the number of seconds the Business Modem waits for a carrier. May be set for much longer duration if, for example, the Business Modem is originating an international connection. |
| S8 | 2 | Sets the duration, in seconds, for the pause (,) option in the Dial command and the pause between command reexecutions (> and A> commands). |
| S9 | 6 | Sets the required duration, in tenths of a second, of the remote device's carrier signal before recognition by the Business Modem. |

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| Register | Default | Function |
|---|---|---|
| S10 | 7 | Sets the duration, in tenths of a second, that the Business Modem waits after loss of carrier before hanging up. This guard time allows the Business Modem to distinguish between a line hit, or other disturbance that momentarily breaks the connection, from a true disconnect (hanging up) by the remote device |
| S11 | 70 | Sets the duration and spacing, in milliseconds, of dialed tones. |
| S12 | 50 | Sets the duration, in fiftieths of a second, of the guard time for the escape code (+++) sequence. |
| S13 | 0 | Bit-mapped register. See Chapter 1, Using the AT Command Set, for instructions about how to set bit-mapped registers.<br>**Bit / Value / Result**<br>0 / 1 / Reset when DTR drops.<br>1 / 2 / Reverse normal Auto Answer operation: On incoming RING, enter Originate Mode and look for an answer tone.<br>2 / 4 / Disable 250 ms pause before result code display.<br>3 / 8 / On DTR signal, autodial the number stored in NVRAM at position 0.<br>4 / 16 / At power-on/reset, autodial number stored in NVRAM at position 0.<br>5 / 32 / Disable HST<br>6 / 64 / Disable MNP Level 3 (used for testing Level 2).<br>7 / 128 / Hardware reset (works like powering off and then on). |
| S14 | 1 | Bit-mapped register. (See Chapter 1, Using the AT Command Set, for instructions about how to set bit-mapped registers.)<br>**Bit / Value / Result**<br>0 / 1 / Disconnect on escape code.<br>1 / 2 / Send result codes only when originating a call. |

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| Register | Default | Function |
|---|---|---|
| S15 | 0 | Bit-mapped register. (See Chapter 1, Using the AT Command Set, for instructions about how to set bit-mapped registers.) |

| Bit | Value | Result |
|---|---|---|
| 0 | 1 | Disable the Business Modem's extra high-frequency equalization if it causes problems on shorter-link calls (for HST modulation only). |
| 1 | 2 | Disable online fallback. |
| 2 | 4 | Disable 450 bps back channel* HST only. |
| 3 | 8 | Reset non-ARQ mode Transmit buffer from 1.5K bytes to 128.* (for the convenience of BBS operators taking calls from remote users of slower modems). |
| 4 | 16 | Disable MNP Level 4; retransmitting the larger Level 4 data blocks may be a problem if you expect a great number of errors during a call. |
| 5 | 32 | Set Backspace key to delete. |
| 6 | 64 | Some earlier 2400 bps MNP modems, not made by 3Com, U.S. Robotics, or Microcom, were not fully compatible with the MNP protocol. If you have difficulty making a successful 2400 bps MNP connection with a remote MNP modem, it may be because of this incompatibility. Set S15 to 64 and try again to make the connection. |
| 7 | 128 | Custom applications only. |
| | | * The default 1.5K byte non-ARQ buffer allows data transfer with X- and Y-modem-type File Transfer Protocols without using flow control. |
| | | The 128-byte option allows remote users with slower modems to stop your transmitted data from scrolling off their screens. When remote users send your computer an XOFF (<Ctrl-S>) and you stop transmitting, the data in transit doesn't exceed the size of their screen. |

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| Register | Default | Function |
|---|---|---|
| S16 | 0 | Bit-mapped register. (See Chapter 1, Using the AT Command Set, for instructions on setting bit-mapped registers.) For testing, see Chapter 14, Testing.<br>**Bit** **Value** **Result**<br>2 4 Test pattern.<br>3 8 Remote digital loopback. |
| S18 | 0 | Test timer for software-initiated loopback testing (&Tn); disabled when S18 is set to 0. Used to set the duration of testing, in seconds, before the Business Modem automatically times out and terminates the test. |
| S19 | 0 | Sets the duration, in minutes, for the Inactivity Timer. The timer activates when there is no data activity on the phone line, and at the timeout the Business Modem hangs up. S19=0 disables the timer. |
| S21 | 10 | Sets, in 10-millisecond units, the length of breaks sent from the Business Modem to the computer or terminal. Applies to ARQ mode only. |
| S22 | 17 | Stores the ASCII code for the XON character.* |
| S23 | 19 | Stores the ASCII code for the XOFF character.* |
| S24 | 150 | Sets the duration, in 20-millisecond units, between pulsed DSR signals when the Business Modem is set to &S2 or &S3. The default is 3 seconds. |
| S25 | 5 | Sets DTR recognition time in 10-millisecond units. |
| S27 | 0 | Bit-mapped register. (See Chapter 1, Using the AT Command Set, for instructions about setting bit-mapped registers.)<br>**Bit** **Value** **Result**<br>0 1 Enable ITU-T V.21 modulation at 300 bps for overseas calls. In V.21 mode, the Business Modem answers both Bell 103 and V.21 calls, but only originates V.21 calls.<br>1 2 Enable unencoded (non- trellis-coded) modulation in V.32 mode; this option is part of the ITU-T V.32 recommendation, but is rarely used.<br>2 4 Disable V.32 modulation; used for testing HST modulation. |

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| Register | Default | Function | | |
|---|---|---|---|---|
| | | **Bit** | **Value** | **Result** |
| | | 3 | 8 | Disable 2100 Hz answer tone to allow two V.42 devices to connect more quickly. |
| | | 4 | 16 | See next page. |
| | | 5 | 32 | See next page. |
| | | 7 | 128 | Unusual software incompatibility. Some software may not accept some result codes. This setting disables the codes and displays the 9600 code instead. The call's actual rate can be viewed on the ATI6 screen. |
| | | | | Error control handshaking options: Select the total value of bits 4 and 5. |
| | | 0 | 0 | Complete handshaking sequence: V.42 Detection, LAPM error control, MNP. |
| | | 16 | 0 | Disable MNP. |
| | | 0 | 32 | Disable V.42 Detection and LAPM. |
| | | 16 | 32 | Disable Detection phase, if you know that the remote modem does LAPM, but not the Detection phase. |
| S28 | 8 | Sets the duration in tenths of a second of the extra 3000/600 Hz answer tones sent during V.32 hand-shaking. This gives V.32 modems additional time to connect in V.32 mode before timing out.If there is difficulty answering older, manually operated V.32 modems (for example, modems that require a button to be pushed in order to dial, try lengthening the duration of the extra tones).Setting S28 to zero eliminates the extra tones resulting in a faster connect time if, for example, the Business Modem is set to use V.21 modulation (300 bps) or V.23 modulation (1200 bps). | | |
| S34 | 0 | Bit-mapped register. See Chapter 1, Using the AT Command Set, for instructions about how to set bit-mapped registers. | | |
| | | **Bit** | **Value** | **Result** |
| | | 0 | 1 | Disable V.32bis. Used for troubleshooting; 3Com Technical Support may ask you to disable V.32bis for testing purposes. |

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| Register | Default | Function | | |
|---|---|---|---|---|
| | | **Bit** | **Value** | **Result** |
| | | 1 | 2 | Disable the Business Modem's enhanced, proprietary V.32bis modulation. Used for troubleshooting. |
| | | 2 | 4 | Disable the faster retrains that occur during proprietary V.32terbo modulation. Used for troubleshooting. |
| | | 3 | 8 | Enable V.23. Required for some British connections. |
| | | 6 | 64 | Disable the remote-access busy message. |
| | | 7 | 128 | Disable V.32terbo. |
| S38 | 0 | Sets the duration, in seconds, before a forced hang-up and clearing of the Transmit buffer when DTR drops during an ARQ call. This is provided to allow time for a remote device to acknowledge receipt of all transmitted data. Default = 0: The Business Modem immediately hangs up when DTR drops. If the Business Modem receives the ATH command, it ignores S38 and immediately hangs up. | | |
| S41 | 0 | Sets the number of allowable remote-access login attempts, thus enabling or disabling remote access. The default setting of zero allows no remote login attempts, thus disabling remote access. A value of 1 or greater enables remote access. If the number of unsuccessful login attempts exceeds the limit set by this register, the Business Modem returns online and any further login attempts during the remainder of that connection are refused. | | |
| S42 | 126 | Stores the ASCII decimal code for the remote-access escape character. The default character is a tilde (~). | | |
| S43 | 200 | Sets the duration, in fiftieths of a second, of the guard time for the remote-access (~~~~) sequence. | | |
| S51 | 0 | Bit-mapped register. See Chapter 1, Using the AT Command Set, for instructions about how to set bit-mapped registers. | | |
| | | **Bit** | **Value** | **Result** |
| | | 0 | 1 | Disable MNP/V.42 for V.22 (1200 bps) |
| | | 1 | 2 | Disable MNP/V.42 for V.22bis (2400 bps) |
| | | 2 | 4 | Disable MNP/V.42 for V.32/V.32bis/V.32terbo (9600/14400/19200/21600 bps). |

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| Register | Default | Function | | |
|---|---|---|---|---|
| | | **Bit** | **Value** | **Result** |
| S53 | 126 | Bit-mapped register. (See Chapter 1, Using the AT Command Set, for instructions about how to set bit-mapped registers.) | | |
| | | 0 | 1 | Enable dial security. |
| | | 1 | 2 | Enable autopass fallback. |
| | | 2 | 4 | Enale local-access password protection. |
| | | | | *Enabling local-access password protection disables the &Zn=s command (which stores up to 10 phone numbers) because stored phone numbers occupy the same space in NVRAM as the dialback numbers for Dial Security accounts.* |
| S54 | 64 | Symbol rate bit-mapped register used primarily by 3Com Technical Support for debugging purposes. | | |
| | | **Bit** | **Value** | **Result** |
| | | 0 | 1 | Disable 2400 symbol rate. |
| | | 1 | 2 | Disable 2743 symbol rate. |
| | | 2 | 4 | Disable 2800 symbol rate. |
| | | 3 | 8 | Disable 3000 symbol rate. |
| | | 4 | 16 | Disable 3200 symbol rate. |
| | | 5 | 32 | Disable 3429 symbol rate. |
| | | 6 | 64 | Disable V.8 Call Indicate (CI). |
| | | 7 | 128 | Disable V.8 Mode. |
| S55 | 0 | Trellis code bit-mapped register used primarily by 3Com Technical Support for debugging purposes. | | |
| | | **Bit** | **Value** | **Result** |
| | | 0 | 1 | Disable 8S-2D mapping. |
| | | 1 | 2 | Disable 16S-4D mapping. |
| | | 2 | 4 | Disable 32S-2D mapping. |
| | | 3 | 8 | Disable 64S-4D mapping. |
| | | 4 | 16 | Reserved. |
| | | 5 | 32 | Reserved. |
| | | 6 | 64 | Reserved. |
| | | 7 | 128 | Enable phase roll detection. |

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| Register | Default | Function |
|---|---|---|
| S56 | 0 | Bit-mapped register primarily used by 3Com Technical Support for debugging purposes.<br>**Bit** **Value** **Result**<br>0 1 Disable non-linear coding.<br>1 2 Disable TX level deviation.<br>2 4 Disable preemphasis.<br>3 8 Disable precoding.<br>4 16 Disable shaping.<br>5 32 Disable V.34+.<br>6 64 Disable V.34.<br>7 128 Disable V.FC. |
| S58 | 0 | Bit-mapped register primarily used by 3Com Technical Support for debugging purposes.<br>**Bit** **Value** **Result**<br>0 1 Disable x2.<br>1 2 Reserved.<br>2 4 Reserved.<br>3 8 Reserved.<br>4 16 Reserved.<br>5 32 Disable V.90.<br>6 64 Reserved.<br>7 128 Reserved. |
| S70 | 0 | Bit-mapped register primarily used by 3Com Technical Support for debugging purposes.<br>**Bit** **Value** **Result**<br>0 1 Enable ring type A.<br>1 2 Enable ring type B.<br>2 4 Enable ring type C.<br>3 8 Enable ring type D.<br>4 16 Reserved.<br>5 32 Reserved.<br>6 64 Reserved.<br>7 128 Reserved. |

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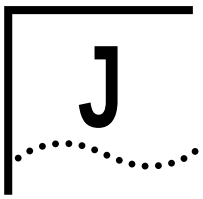

# WARRANTY

**3COM CORPORATION LIMITED WARRANTY**

**3Com OfficeConnect 56K Business Modem**

3Com warrants this hardware product to be free from defects in workmanship and materials, under normal use and service, for the lifetime of the product from the date of purchase from 3Com or its authorized reseller. 3Com's sole obligation under this express warranty shall be, at 3Com's option and expense, to repair the defective product or part, deliver to Customer an equivalent product or part to replace the defective item, or if neither of the two foregoing options is reasonably available, 3Com may, in its sole discretion, refund to Customer the purchase price paid for the defective product. All products that are replaced will become the property of 3Com. Replacement products may be new or reconditioned. 3Com warrants any replaced or repaired product or part for ninety (90) days from shipment, or the remainder of the initial warranty period, whichever is longer.

YEAR 2000 WARRANTY: In addition to the Hardware Warranty stated above, 3Com warrants that each product sold or licensed to Customer on and after January 1, 1998 that is date sensitive will continue performing properly with regard to such date data on and after January 1, 2000, provided that all other products used by Customer in connection or combination with the 3Com product, including hardware, software, and firmware, accurately exchange date data with the 3Com product, with the exception of those products identified at 3Com's Web site,

**http://www.3com.com/products/yr2000.html**

as not meeting this standard. If it appears that any product that is stated to meet this standard does not perform properly with regard to such date

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data on and after January 1, 2000, and Customer notifies 3Com before the later of April 1, 2000, or ninety (90) days after purchase of the product from 3Com or its authorized reseller, 3Com shall, at its option and expense, provide a software update which would effect the proper performance of such product, repair such product, deliver to Customer an equivalent product to replace such product, or if none of the foregoing is feasible, refund to Customer the purchase price paid for such product.

Any software update or replaced or repaired product will carry a Year 2000 Warranty for ninety (90) days after purchase or until April 1, 2000, whichever is later.

OBTAINING WARRANTY SERVICE: Customer must contact a 3Com Corporate Service Center or an Authorized 3Com Service Center within the applicable warranty period to obtain warranty service authorization. Dated proof of purchase from 3Com or its authorized reseller may be required. Products returned to 3Com's Corporate Service Center must be pre-authorized by 3Com with a Service Repair Order (SRO) number marked on the outside of the package, and sent prepaid and packaged appropriately for safe shipment, and it is recommended that they be insured or sent by a method that provides for tracking of the package. The repaired or replaced item will be shipped to Customer, at 3Com's expense, not later than thirty (30) days after 3Com receives the defective product. Return the product to:

**3Com**
**Client SRO# _____**
**1800 W. Central Ave.**
**Mt. Prospect, IL 60056**

3Com shall not be responsible for any software, firmware, information, or memory data of Customer contained in, stored on, or integrated with any products returned to 3Com for repair, whether under warranty or not.

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GOVERNING LAW: This Limited Warranty shall be governed by the laws of the State of California, U.S.A. excluding its conflicts of laws principles and excluding the United Nations Convention on Contracts for the International Sale of Goods.

***Important:*** *If you send your unit, pack it securely and be sure your SRO number is visible on the outside of the package.*

## Notices

**FCC Certification Statement**

3Com
3800 Golf Rd.
Rolling Meadows, IL 60008

## FCC Registration

| | | |
|---|---|---|
| **FCC15** | CJE-0263 | CJE-0396 |
| **FCC68** | CJEUSA-73130-FA-E<br>CJEUSA-24161-M5-E | CJEUSA-30043-MM-E |
| **Ringer Equivalence** | 0.4B | 0.4B |

## FCC Notice

The user may find the following information prepared by the Federal Communications Commission helpful:

The CIB Interference Handbook and The CIB Telephone Interference Bulletin.

These documents are available on the Internet through the FCC Compliance and Interference Bureau Home Page at http://www.fcc.gov/cib listed under documents. Select CIB Interference Handbook or CIB Telephone Interference Bulletin.

*Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.*

*Users should not attempt to make electrical ground connections by themselves, but should contact the appropriate inspection authority or electrician, as appropriate.*

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## FCC Notice: Radio and Television Interference

*This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules.*

These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

The user may find the following information prepared by the Federal Communications Commission helpful:

The CIB Interference Handbook and The CIB Telephone Interference Bulletin.

These documents are available on the Internet through the FCC Compliance and Interference Bureau Home Page at http://www.fcc.gov/cib listed under documents. Select CIB Interference Handbook or CIB Telephone Interference Bulletin.

*Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.*

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**IC (Industry Canada)**

This digital apparatus does not exceed the Class B limits for radio noise

emissions from digital apparatus set out in the interference-causing equipment standard entitled Digital Apparatus, ICES-003 of Industry Canada.

Cet appareil numérique respecte les limites de bruits radio-électriques applicables aux appareils numériques de la Classe B préscrites dans la norme sur le matériel brouilleur: Appareils Numériques, NMB-003 édictée par l'Industrie Canada

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. The department does not guarantee the equipment will operate to a user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the inside wiring associated with a single-line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by a user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

***CAUTION:*** *Users should not attempt to make electrical ground connections by themselves, but should contact the appropriate inspection authority or electrician, as appropriate.*

**UL Listed Accessory**

Your modem is a UL listed accessory. It must be used with a UL listed computer.

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# GLOSSARY

**16550 UART** The fastest type of UART that is currently available.

**Adaptive Speed Leveling (ASL)** Business Modem V.32 *bis* and V.32 *terbo* modems detect improved line conditions and shift upward again to the next higher speed. The modems at both ends of the connection adapt independently, each detecting and adjusting to line conditions. ASL keeps the modems online, always operating at the highest possible speed, and constantly ensuring data integrity.

**analog signals** Continuous, varying waveforms such as the voice tones carried over phone lines. Contrast with digital signals.

**answer mode** A state in which the modem transmits at the predefined high frequency of the communications channel and receives at the low frequency. The transmit/receive frequencies are the re-verse of the calling modem which is in originate mode.

**application (application program)** A computer program designed to perform a specific function, such as a word processor or a spreadsheet.

**ARQ** See Automatic Repeat Request.

**ASCII** American Standard Code for Information Interchange. A 7-bit binary code (0's, 1's) used to represent letters, numbers, and special characters such as $,!, and /. Supported by almost every computer and terminal manufacturer.

**ASL** See Adaptive Speed Leveling.

**asymmetrical modulation** A transmission technique that splits the communications channel into one high speed channel and one slower channel. During a call under asymmetrical modulation, the modem with the greatest amount of data to transmit is allocated the high speed channel. The modem with less data is allocated the slow, or back channel (450 bps). The modems

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dynamically reverse the channels during a call if the volume of data transfer changes.

**asynchronous transmission** Data transmission in which the length of time between transmitted characters may vary.

Because the time lapses between transmitted characters are not uniform, the receiving modem must be signaled as to when the data bits of a character begin and when they end. The addition of start and stop bits to each character serves this purpose.

**auto answer** A feature in modems enabling them to answer incoming calls over the phone lines without the use of a telephone receiver.

**auto dial** A feature in modems enabling them to dial phone numbers over the phone system without the use of a telephone transmitter.

**Automatic Repeat Request (ARQ)** A general term for error control protocols which feature error detection and automatic retransmission of defective blocks of data. See HST, MNP, and V.42.

**baud rate** The number of discrete signal events per second occurring on a communications channel. Although not technically accurate, baud rate is commonly used to mean bit rate.

**binary digit (bit)** A 0 or 1, reflecting the use of a binary numbering system (only two digits). Used because the computer recognizes either of two states, OFF or ON. Shortened form of binary digit is bit.

**bit** See binary digit.

**bit-mapping** A technique that lets one decimal number (in this case, a number between 0 and 255) stand for up to 8 separate binary settings.

**bit rate** The number of binary digits, or bits, transmitted per second (bps). Communications channels using telephone channel modems are established at set bit rates, commonly 300, 1200, 2400, 4800, 9600, 14400, and 28800.

**bps** The bits (binary digits) per second rate.

**buffer** A memory area used as temporary storage during input and output operations. An example is the modem's command buffer. Another is the Transmit Data flow control buffer used for flow control and to store

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copies of transmitted frames until they are positively acknowledged by the receiving modem.

**byte** A group of binary digits stored and operated upon as a unit. A byte may have a coded value equal to a character in the ASCII code (letters, numbers), or have some other value meaningful to the computer. In user documentation, the term usually refers to 8-bit units or characters. 1 kilobyte (K) is equal to 1,024 bytes or characters; 64K indicates 65,536 bytes or characters.

**call indicate** A call originating tone defined by ITU-T recommendation V.8.

**carrier** A continuous frequency capable of being either modulated or impressed with another information carrying signal. Carriers are generated and maintained by modems via the transmission lines of the telephone companies.

**CCITT** Formerly, an international organization that defined standards for telegraphic and telephone equipment. It has been incorporated into its parent organization, International Telecommunication Union (ITU). Telecommunication standards are now covered under Telecommunications Standards Sector (TSS). ITU-T replaces CCITT. For example, the Bell 212A standard for 1200 bps communication in North America was referred to as CCITT V.22. It is now referred to as ITU-T V.22.

**central office (CO)** The facility to which devices, such as telephones, fax machines, and modems within a specific geographic area of a public telephone network are connected.

**central office switch** A device, located at the telephone company's central office, to which devices, such as telephones, fax machines, and modems are connected.

**character** A representation, coded in binary digits, of a letter, number, or other symbol.

**characters per second (cps)** A data transfer rate generally estimated from the bit rate and the character length.

For example, at 2400 bps, 8-bit characters with start and stop bits (for a total of ten bits per character) will be transmitted at a rate of approximately 240 characters per second (cps). Some protocols, such as HST and MNP, employ advanced techniques such as longer transmission frames and data compression to increase cps.

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**Class 1/EIA-578** An American standard used between facsimile application programs and facsimile modems for sending and receiving Class 1 faxes.

**Class 2.0/EIA-592** An American standard used between facsimile application programs and facsimile modems for sending and receiving Class 2.0 faxes.

**CO** See central office.

**COM port** See serial port, EIA-232.

**cps** See characters per second.

**CPU** Central processing unit.

**CRC** See cyclic redundancy check.

**cyclic redundancy check (CRC)** An error-detection technique consisting of a cyclic algorithm performed on each block or frame of data by both sending and receiving modems. The sending modem inserts the results of its computation in each data block in the form of a CRC code. The receiving modem compares its results with the received CRC code and responds with either a positive or negative acknowledgment. In the ARQ protocol implemented in 3Com high speed modems, the receiving modem accepts no more data until a defective block is received correctly.

**data communications** A type of communications in which computers and terminals are able to exchange data over an electronic medium.

**data compression** When the transmitting modem detects redundant units of data, it recodes them into shorter units of fewer bits. The receiving modem then decompresses the redundant data units before passing them to the receiving computer.

**data compression table** A table of values assigned for each character during a call under data compression. Default values in the table are continually altered and built during each call: the longer the table, the more efficient throughput gained.

If a destructive Break is sent during a call (see the &Y command), causing the modems to reset the compression tables, you can expect diminished throughput.

**data communication equipment (DCE)** In this manual, the term applies to modems that establish and control the data link via the telephone network.

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**data mode** The mode in which the fax modem is capable of sending and receiving data files. A standard modem without fax capabilities is always in Data mode.

**data set** Another way of saying "modem."

**data terminal equipment (DTE)** The device that generates or is the final destination of data.

**DCE** See data communication equipment.

**default** Any setting assumed, at startup or reset, by the computer's soft-ware and attached devices, and operational until changed by the user.

**digital loopback** A test that checks the modem's EIA-232 interface and the cable that connects the terminal or computer and the modem. The modem receives data (in the form of digital signals) from the computer or terminal, and immediately returns the data to the screen for verification.

**digital signals** Discrete, uniform signals. In this manual, the term refers to the binary digits 0 and 1.

**DSR** See data set ready.

**DTE** See Data Terminal Equipment.

**duplex** Indicates a communications channel capable of carrying signals in both directions. See Half Duplex, Full Duplex.

**echo** See local echo.

**EIA** Electronic Industries Association, which defines electronic standards in the U.S.

**EIA-232** A technical specification published by the Electronic Industries Association that establishes mechanical and electrical interface requirements between computers, terminals, modems, and communication lines. EIA-232 was formerly known as RS-232.

**equalization** A compensation circuit designed into modems to counteract certain distortions introduced by the telephone channel. Two types are used: fixed (compromise) equalizers and those that adapt to channel conditions. 3Com high speed modems use adaptive equalization.

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**error control** Various techniques which check the reliability of characters (parity) or blocks of data. V.42, MNP and HST error control protocols use error detection (CRC) and retransmission of errored frames (ARQ).

**expansion bus** A series of slots inside a computer that allow for adding feature cards.

**facsimile (fax)** A method for transmitting the image on a printed page from one point to another.

**fax mode** The mode in which the fax modem is capable of sending and receiving files in a facsimile format.

**Flash memory** A form of memory that can be electrically erased and reprogrammed without the need to remove it from the circuit board.

**flow control** A mechanism that compensates for differences in the flow of data input to and output from a modem or other device.

**frame** A data communications term for a block of data with header and trailer information attached. The added information usually includes a frame number, block size data, error-check codes, and Start/End indicators.

**file transfer protocol (FTP)** A TCP/IP application that allows users of an internet to send (put) and receive (get) files.

**FTP** See file transfer protocol.

**full duplex** Signal flow in both directions at the same time. In micro-computer communications, may refer to the suppression of the online Local Echo.

**half duplex** Signal flow in both directions, but only one way at a time. In microcomputer communications, may refer to activation of the online Local Echo, which causes the modem to send a copy of the transmitted data to the screen of the sending computer.

**handshaking** A sequence that two modems undertake while connecting to agree on the parameters of the conversation that will ensue. During handshaking, the modems negotiate the speed of the connection, whether error control and data compression will be used and in what form, and so forth.

**hardware flow control** A form of flow control that uses electronic signals to start and stop the flow of data.

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**HDLC** See High Level Data Link Control.

**High Speed Technology (HST)** 3Com' proprietary signaling scheme, design and error control protocol for high-speed modems. HST incorporates trellis-coded modulation, for greater immunity from variable phone line conditions, and asymmetrical modulation for more efficient use of the phone channel at speeds of 4800 bps and above. HST also incorporates MNP-compatible error control procedures adapted to asymmetrical modulation.

**Hz (Hertz)** A frequency measurement unit used internationally to indicate one cycle per second.

**Industry Standard Architecture (ISA)** The most common type of computer expansion bus. Other types include Extended Industry Standard Architecture (EISA) and Microchannel Architecture (MCA).

**interrupt request (IRQ)** A number that must be assigned to devices that plug in to your computer's expansion bus.

**IP** Internet Protocol.

**IPX** Novell's Internet Packet Exchange protocol.

**IRQ** See interrupt request.

**ISA** See Industry Standard Architecture.

**ITU-T** International Telecommunication Union-Telecommunication sector. Formerly referred to as CCITT. An international organization that defines standards for telegraphic and telephone equipment. For example, the Bell 212A standard for 1200 bps communication in North America is observed internationally as ITU-T V.22. For 2400 bps communication, most U.S. manufacturers observe V.22 *bis*.

**jumper** A switch composed of pins and a shunt. The shunt's position on the pins determines the jumper setting.

**Kbps** Kilobits per second, or thousand bits per second.

**LAPM** See Link Access Procedure for Modems.

**Link Access Procedure for Modems (LAPM)** Link Access Procedure for Modems, an error control protocol incorporated in ITU-T Recommendation V.42. Like the MNP and HST protocols, LAPM uses cyclic redundancy checking (CRC) and retransmission of corrupted data (ARQ) to ensure data reliability.

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**local echo** A modem feature that enables the modem to send copies of key-board commands and transmitted data to the screen. When the modem is in Command mode (not online to another system) the local echo is invoked through the ATE1 command. The command causes the modem to display your typed commands. When the modem is online to another system, the local echo is invoked through the ATF0 command. This command causes the modem to display the data it transmits to the remote system.

**MB** Megabyte. One million bytes.

**Microcom Networking Protocol (MNP)** An asynchronous error control protocol developed by Microcom, Inc. and now in the public domain. The protocol ensures error-free transmission through error detection (CRC) and retransmission of errored frames. 3Com modems use MNP Levels 1-4 and Level 5 data compression. MNP Levels 1-4 have been incorporated into ITU-T Recommendation V.42. Compare HST.

**MI/MIC** Mode Indicate/Mode Indicate Common. Also called fixed or manual originate. Used when equipment other than the modem does the dialing. In such installations, the modem does not respond to AT commands, but when taken off hook immediately goes into call originate mode.

**MNP** See Microcom Networking Protocol.

**modem** A device that transmits/receives computer data through a communications channel such as radio or telephone lines. The Business Modem is a telephone channel modem that modulates, or transforms, digital signals from a computer into the analog form that can be carried successfully on a phone line. It also demodulates signals received from the phone line back to digital signals before passing them to the receiving computer.

**Nonvolatile Random Access Memory (NVRAM)** User-programmable random access memory whose data is retained when modem power is turned off. Used in modems to store a user-defined default configuration loaded into random access memory (RAM) at power on.

**NVRAM** See Non-volatile Random Access Memory.

**online fallback** A feature that allows high speed error-control modems to monitor line quality and fall back to the next lower speed if line quality degrades. The modems fall forward as line quality improves.

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**originate mode** A state in which the modem transmits at the predefined low frequency of the communications channel and receives at the high frequency. The transmit/receive frequencies are the reverse of the called modem which is in Answer mode.

**parallel transmission** The transfer of data characters using parallel electrical paths for each bit of the character, for example, 8 paths for 8-bit characters. Data is stored in computers in parallel form, but may be converted to serial form for certain operations. See Serial Transmission.

**parity** An error-detection method that checks the validity of a transmitted character. Character checking has been surpassed by more reliable and efficient forms of block-checking, including Xmodem-type protocols and the ARQ protocol implemented in modems.

The same type of parity must be used by two communicating computers, or both may omit parity. When parity is used, a parity bit is added to each transmitted character. The bit's value is 0 or 1, to make the total number of 1's in the character even or odd, depending on which type of parity is used.

**Plug & Play ISA** A variation of the standard ISA bus that attempts to automate the troublesome process of resolving the IRQ and COM port conflicts that can arise when new devices are installed in ISA-bus computers.

**Point-to-Point Protocol (PPP)** A protocol used to send data over serial lines. PPP provides error checking, link control, and authentication, and can be used to carry IP, IPX, and other protocols. PPP is superseding SLIP as the leading dial-in protocol.

**protocol** A system of rules and procedures governing communications between two or more devices. Protocols vary, but communicating devices must follow the same protocol in order to exchange data. The format of the data, readiness to receive or send, error detection and error correction are some of the operations that may be defined in protocols.

**provisioning** Another way of saying "setting up telephone lines."

**RAM** See Random Access Memory.

**Random Access Memory (RAM)** Random Access Memory. Memory that is available for use when the modem is turned on, but that clears of all information when the power is turned off. The modem's RAM holds the current operational settings, a flow control buffer, and a command buffer.

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**Read-Only Memory (ROM)** Permanent memory, not user-programmable. The Business Modem's factory settings are stored in ROM.

**remote access** A feature that allows a remotely-located user to view the Business Modem's configuration screens and change the Business Modem's configuration. Password protection is available.

**remote digital loopback** A test that checks the phone link and a remote modem's transmitter and receiver. Data entered from the keyboard is transmitted from the initiating modem, received by the remote modem's receiver, looped through its transmitter, and returned to the local screen for verification.

**remote echo** A copy of the data received by the remote system, returned to the sending system and displayed on the screen. Remote echoing is a function of the remote system.

**result code** Another way of saying "status message." The Business Modem sends result codes to your terminal, for example, to indicate the status of a connection.

**RJ11** The Universal Standard Order Code (USOC) standard for wiring a single-line, two-wire phone network interface, passing tip and ring signals, typically, from the public switched network.

**ROM** See Read-Only Memory.

**Serial Line Internet Protocol (SLIP)** A simple protocol that permits sending IP data over a serial line. SLIP is being superseded by the Point-to-Point Protocol (PPP).

**serial port** A computer port that enables the transmission of data characters one bit at a time, using a single electrical path. Also known as a communications port, or COM port. On PC-compatible machines, this is a port for asynchronous, serial data transmission and, in the case of modems, for data reception. Data is transmitted one bit at a time (serially) to devices such as a modem, a serial mouse, or a serial printer.

**serial transmission** The transfer of data characters one bit at a time, sequentially, using a single electrical path. See Parallel Transmission.

**software flow control** A form of flow control that uses XON and XOFF characters to start and stop the flow of data.

**start bit** The signaling bit attached to the beginning of each character before characters are transmitted during Asynchronous Transmission.

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**stop bit** The signaling bit attached to the end of each character before characters are transmitted during Asynchronous Transmission.

**shunt** A small, plastic-and-metal piece used to cover sections of pins on a jumper. The shunt interconnects certain pins which, depending on the way the shunt is placed, determine functions.

**S-register** An area of NVRAM that is used to store a setting.

**switch** See central office switch.

**terminal** A device whose keyboard and display are used for sending and receiving data over a communications link. Differs from a microcomputer in that it has no internal processing capabilities. Used to enter data into or retrieve processed data from a system or network.

**terminal mode** An operational mode required for microcomputers to transmit data. In Terminal mode the computer acts as if it were a standard terminal such as a teletypewriter, rather than a data processor. Keyboard entries go directly to the modem, whether the entry is a modem command or data to be transmitted over the phone lines. Received data is output directly to the screen. The more popular communications software products control Terminal mode as well as enable more complex operations, including file transmission and saving received files.

**throughput** The amount of actual user data transmitted per second with-out the overhead of protocol information such as Start and Stop bits or frame headers and trailers. Compare characters per second.

**transmission rate** See it rate.

**UART** See Universal Asynchronous Receiver/Transmitter.

**Universal Asynchronous Receiver/Transmitter (UART)** A computer chip that controls the signaling that goes on through a computer's serial port.

**UTP (Unshielded Twisted Pair)** Twisted insulated copper wires bundled into an unshielded cable, commonly used in telephone wiring systems. Grades of UTP include DTP (Datagrade Twisted Pair) and DIW (Distributed Inside Wire).

**V.8** ITU-T recommendation that defines procedures for starting and ending sessions of data transmission.

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**V.17** An ITU-T standard for facsimile operations that specifies modulation at 14.4 Kbps, with fallback to 12 Kbps.

**V.21-Fax** An ITU-T standard for facsimile operations at 300 bps. 3Com or compatible fax devices then transmit or receive at higher speeds.

**V.21-Modem** An ITU-T standard for modem communications at 300 bps. Modems made in the U.S. or Canada follow the Bell 103 standard. However, the modem can be set to answer V.21 calls from overseas.

**V.22** A ITU-T standard for modem communications at 1200 bps, compatible with the Bell 212A standard observed in the U.S. and Canada.

**V.22 *bis*** An ITU-T standard for modem communications at 2400 bps. The standard includes an automatic link negotiation fallback to 1200 bps and compatibility with Bell 212A/V.22 modems.

**V.23** An ITU-T standard for modem communications at 1200 bps with a 75 bps back channel. Used in the U.K.

**V.25** An ITU-T standard for modem communications. Among other things, V.25 specifies an answer tone different from the Bell answer tone. All 3Com modems can be set with the B0 command so that they use the V.25 2100 Hz tone when answering overseas calls. (Not applicable to the Business Modem.)

**V.25 *bis*** An ITU-T standard for synchronous communications between the mainframe or host and the modem using the HDLC or character-oriented protocol. Modulation depends on the serial port rate and setting of the transmitting clock source, &X. (Not applicable to the Business Modem.)

**V.27*ter*** An ITU-T standard for facsimile operations that specifies modulation at 4800 bps, with fallback to 2400 bps.

**V.29** An ITU-T standard for facsimile operations that specifies modulation at 9600 bps, with fallback to 7200 bps.

**V.32** An ITU-T standard for modem communications at 9600 bps and 4800 bps. V.32 modems fall back to 4800 bps when line quality is impaired, and fall forward again to 9600 bps when line quality improves.

**V.32 *bis*** An ITU-T standard that extends the V.32 connection range: 4800, 7200, 9600, 12K and 14.4 Kbps. V.32 bis modems fall back to the next lower

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speed when line quality is impaired, and fall back further as necessary. They fall forward to the next higher speed when line quality improves.

**V.32 *terbo*** Modulation scheme that extends the V.32 connection range: 4800, 7200, 9600, 12K, 14.4K, 16.8K, 19.2K, and 21.6 Kbps. V.32 terbo modems fall back to the next lower speed when line quality is impaired, and fall back further as necessary. They fall forward to the next higher speed when line quality improves.

**V.34** An ITU-T standard that allows data rates as high as 28.8 Kbps.

**V.35** An ITU-T standard trunk interface between a device and a packet network, using signaling of at least 19200 bps.

**V.42** An ITU-T standard for modem communications that defines a two-stage process of detection for LAPM error control.

**V.42 *bis*** An extension of ITU-T V.42 that defines a specific data compression scheme for use with V.42 error control.

**V.Fast Class (V.FC)** Proprietary modulation scheme developed by Rockwell International for data communication speeds up to 28.8 Kbps.

**word length** The number of bits in a data character without parity, start or stop bits.

**XMODEM** The first of a family of error control software protocols used to transfer files between modems. These protocols are in the public domain and are available from many bulletin board services.

**XON/XOFF** Standard ASCII control characters used to tell a device to stop/resume transmitting data. In most systems typing <Ctrl>-S sends the XOFF character. Some devices, including the Business Modem, understand <Ctrl>-Q as XON; others interpret the pressing of any key after <Ctrl>-S as XON.

**YMODEM** An error-correcting file transfer protocol that is related to, but faster than, XMODEM.

**ZMODEM** An error-correcting file transfer protocol that is related to, but faster than, XMODEM or YMODEM.

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